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UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

Covering the Literature on Atomic Energy
in the Fields of

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NUCLEAR SCIENCE ABSTRACTS

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NP-3398	Nuclear and Electronic Paramagnetism and Low Temperature Studies: Fifth Annual Progress Report. F. G. Dunnington.	7230
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NP-3402	Quarterly Progress Report. A. G. Hill, J. B. Wiesner, and G. G. Harvey.	7124
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NP-3433	A Study of the Mechanism of the Delayed Yield Phenomenon. T. Vreeland, Jr., D. S. Wood, and D. S. Clark.	7083
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NP-3436	Final Report [on Indium Studies]. M. F. Stubbs.	7105
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NP-3443	A Method of Correlating Heat Transfer Data for Surface Boiling of Liquids (Technical Report No. 5). Warren M. Rohsenow.	7069
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NP-3447	Fatigue Testing and Test Interpretation; Technical Report No. 26 on the Behavior of Materials under Repeated Stress. A. M. Freudenthal.	7082
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TEM-102A	Investigations in the Wood Mine, Colorado. Robert U. King.	7098

GENERAL

ATOMIC BOMBS AND WARFARE

6947

PUBLIC HEALTH ASPECTS OF CIVIL DEFENSE FROM ATOMIC WEAPONS. James P. Cooney. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.129-32.

Responsibility of American physicians in making realistic preparations for atomic bombing of our cities is pointed out. Types of casualties which may be expected, blast effects, thermal effects, and effects of radioactivity from air bursts, ground bursts, and underwater bursts are discussed.

ATOMIC POWER

6948

GROWTH IN PEACETIME USES OF ATOMIC ENERGY. Paul C. Aebersold. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.17-28.

The use of atomic energy for production of heat and electrical power, the use of atomic radiation and atomic heat to induce chemical and physical changes, applications of results of researches in atomic science to other fields, and the application of radioactive isotopes for tracing atoms and other unique purposes are discussed. Present uses of radioisotopes in medicine, agriculture, the basic sciences, and industry are summarized.

RESEARCH PROGRAMS

6949

RADIOISOTOPES TECHNIQUES CONFERENCE — OXFORD, 1951. J. L. Putman. Nucleonics 9, No. 4, 5-16(1951) Oct.

A review of the papers presented at the Radioisotopes Techniques Conference includes radioisotope applications in the following fields: therapy and diagnosis in general, I^{131} therapy for the thyroid cancer, thyrotoxicosis diagnosis and therapy with I^{131}, γ-ray therapy, biochemical studies, chromatography, and electron-track radiography; soils and fertilizers and plant nutrition; and determination of silver in photographic images, industrial radiography, nondestructive testing, elimination of static electric charges, and radioactivation analyses.

BIOLOGY AND MEDICINE

6950

Hanford Works

ABSORPTION OF PLUTONIUM FED CHRONICALLY TO RATS; I. EFFECT OF SEX ON FRACTION ABSORBED AFTER HIGH DOSAGE LEVELS; by J. Katz, C. W. DeLong, M. E. Getzendaner, A. C. Case, and Esther S. Miller, Mar. 13, 1951. 11p. (HW-20941(pt. 1))

Preliminary investigations undertaken to determine the percentage absorption from the rat's gastrointestinal tract of Pu administered chronically and to find whether the sex of the animal plays a role in the rate of absorption are described. Five male and five female rats each received perorally an average of 5.9 μg of Pu^{239} (+4) as the nitrate over a period of 90 days. Radiochemical analyses indicated that an average of 0.0095% of the administered dose was deposited in the total carcass. The pelt contained negligible amounts, but the gastrointestinal tract and contents retained considerable quantities of Pu even after a fast of 3 to 5 days. There was no evidence of any sex difference in Pu retention.

6951

Radiation Lab., Univ. of Calif.

THE EFFECT OF AGE AND LOW PHOSPHORUS RICKETS ON CALCIFICATION AND THE DEPOSITION OF CERTAIN RADIOACTIVE METALS IN BONE; by D. H. Copp, J. G. Hamilton, D. C. Jones, D. M. Thomson, and C. Cramer. Sept. 1951. 31p. (UCRL-1464)

The effect of age and low-P rickets on the retention of Ca^{45}, $Sr^{89,90}$, Ba^{140}, Y^{88}, and Ce^{144} in bone was investigated. The radioactive metals were injected into young growing rats in which there was active growth of new bone, young rats with low-P rickets in which new osteoid matrix was forming but deposition of bone salt did not take place, and mature adult rats in which bone growth had practically ceased. Urine and feces were collected separately and the animals were sacrificed after 8 days. Excreta and tissues were analyzed for radioisotope and radioautographs prepared from thin undecalcified sections of bone. Data indicate the metabolism of Ca, Sr, and Ba was markedly affected by age and low-P rickets, while metabolism of other heavy metals such as Y and Ce was not affected. Radioautographs of rachitic femur show that $Sr^{89,90}$ and Ca^{45} were deposited only in the presence of bone salt, while Y^{88} and Ce^{144} and other heavy metals were also laid down in uncalcified osteoid matrix. Kinetic studies of skeletal uptake and excretion of radiocalcium and radiostrontium showed considerable mineral exchange, even in adult rats. Skeletal uptake was more rapid and greater in growing animals, and the radioactive isotopes remained fixed in the new bone salt. In rachitic rats the initial uptake by bone was rapid, but Ca^{45}

or $Sr^{89,90}$ was then rapidly lost from the skeleton and excreted in urine. When normal animals were injected with Ca^{45} or $Sr^{89,90}$, and then fed a diet low in P, the excretion of the radioactive isotopes in urine was increased, and removal from the skeleton was accelerated.

6952

Brookhaven National Lab.

THE UTILIZATION OF AMMONIUM NITROGEN FOR GROWTH AND TOXIN PRODUCTION BY A STRAIN OF CORYNEBACTERIUM DIPHTHERIAE; by Ruth M. Drew. 7p. (BNL-1006)

The utilization of inorganic nitrogen in addition to organic nitrogen by a strain of Corynebacterium diphtheriae was investigated. Ammonium nitrogen in the form of a simple ammonium salt (ammonium sulfate) was shown to be utilized by the organism. For optimum growth and toxin production on chemically defined medium, suitable concentrations of sodium glutamate and ammonium sulfate, or of ammonium glutamate were required.

6953

Atomic Energy Project, Univ. of Rochester

ACTH AND CORTISONE AGGRAVATION OF THE FEBRILE RESPONSE OF RABBITS TO BACTERIAL ENDOTOXIN; by B. J. Duffy, Jr. and H. R. Morgan. Oct. 11, 1951. 8p. (UR-187)

ACTH in divided doses of 15 mg/day and cortisone (10 mg/day), for 48 hr prior to the intravenous injection of a bacterial endotoxin (Shiga dysenteriae), and injection of 10 mg of either compound, during the 2 days following the antigen treatment, resulted in a significant lessening of the febrile response in the treated as compared to the control animals. Rabbits given smaller doses of ACTH (5 mg/day) and of cortisone (5 mg/day) for 24 hr prior to the injection of antigen, the doses being continued through the test period, demonstrated an aggravated febrile and systemic response to the injected endotoxin compared to the controls. The significance of this time-dose relationship in the interpretation of experiments involving the use of ACTH and cortisone and antigenic materials is discussed.

6954

RADIOISOTOPE PROCEDURES WITH FARM ANIMALS — II. QUANTITATIVE ADMINISTRATION AND BLOOD-SAMPLING. Sam L. Hansard, C. L. Comar, and M. P. Plumlee. Nucleonics 9, No. 2, 38-45(1951) Aug.

Methods for the quantitative administration of radioisotopes to cattle, sheep, and swine are described in detail. Shielding requirements are discussed, including a description of a syringe shield; procedures for intravenous administration, including venous catheterization, are given; techniques for intraperitoneal administration are treated briefly; and oral administration by capsules and by stomach tube is fully outlined. Methods of procuring blood samples are described.

6955

LIGHT PRODUCTION BY GREEN PLANTS. Bernard L. Strehler and William Arnold. J. Gen. Physiol. 34, 809-20 (1951) July 20.

Green plants have been found to emit light of approximately the same color as their fluorescent light for several minutes following illumination. This light is about 10^{-3} the intensity of the fluorescent light, about 0.1 sec after illumination below saturation, or 10^{-6} of the intensity of the absorbed light. The decay curve follows bimolecular kinetics at 6.5°C and reaction order 1.6 at 28°C. An action spectrum for light emitted as a function of the wavelength of exciting light parallels closely the photosynthetic action spectrum. The intensity of light emission was studied as a function of temperature and found to be optimal at about 37°C with an activation energy of ~19,500 cal. Five per cent CO_2 reversibly depresses the amount of light emitted by about 30%. Various inhibitors of photosynthesis were all inhibitory at appropriate concentrations. Irradiation with ultraviolet light (2537 A) inhibits light production at about the same rate as it inhibits photosynthesis. This evidence suggests that early and perhaps later chemical reactions in photosynthesis may be partially reversible.

RADIATION EFFECTS

6956

Atomic Energy Project, Univ. of Rochester

THE EFFECT OF EARLY SMALL EXCHANGE TRANSFUSION ON THE X-IRRADIATED DOG; by S. N. Swisher and F. W. Furth. Oct. 11, 1951. 12p. (UR-186)

Immediate removal of 250 cc of blood and replacement with an equal volume of normal compatible whole blood in 20-lb dogs given 550 r whole body irradiation (expected LD_{80}) results in a marked delay in onset of radiation syndrome and mortality. There is a suggestive decrease in ultimate mortality as well. No differences in average leucocyte count, platelet count, or hematocrit in transfused dogs and in control dogs were observed, nor were there differences in clinical or postmortem anatomical findings.

6957

Army Medical Research Lab., Fort Knox

THE PROTECTIVE EFFECT OF PITRESSIN AND OF EPINEPHRINE AGAINST TOTAL BODY X-RADIATION (Report No. 64); by John L. Gray, Elizabeth J. Moulden, John T. Tew, and H. Jensen. Sept. 18, 1951. 12p. (AMRL-64)

The survival of rats, exposed to lethal x-ray dosage, was found to be significantly increased after pretreatment with pitressin or epinephrine. The protective effect is attributed to their property of producing a temporary tissue anoxia.

6958

Atomic Energy Project, Univ. of Calif., Los Angeles

THE PRESENCE AND IDENTITY OF VASOTROPIC SUBSTANCES IN THE BLOOD OF RATS SUBJECTED TO ACUTE WHOLE BODY ROENTGEN RAY IRRADIATION; by T. J. Haley, Margaret R. Andem, Richard F. Riley, and Idamae Williams. Issued Oct. 18, 1951. 17p. (UCLA-161)

A systematic study has been made of the effect of 600 r of acute whole and regional x irradiation on the peripheral vascular system of the rat. The effects of such radiation upon the formed elements of the blood, the intestinal tract, and other body tissues have been correlated with the published data concerning radiation damage of these tissues. It has been demonstrated that peripheral vascular function is not impaired by a direct action of the radiation on the precapillary sphincters and terminal arterioles but is mediated through the release of a vasodepressor material (VDM) by the liver. This material, which is present in the circulation during the first post-irradiation week, has been shown to be the same as that which appears in the blood of animals in irreversible shock. It fits all the criteria for ferritin. However, the sequence of its appearance is different from that reported for physiological shock states. A vasoexcitor material (VEM) has been found in the blood of irradiated animals during the second post-irradiation week. This material fits the criteria established for the VEM found in the blood of animals in the reversible phase of shock. (auth)

6959

LOW-TEMPERATURE STERILIZATION OF ORGANIC TISSUE BY HIGH-VOLTAGE CATHODE-RAY IRRADIATION. Irving A. Meeker, Jr., and Robert E. Gross. Science 114, 283-85(1951) Sept. 14.

A study was made of sterilization methods for human tissue, such as blood vessels, bone, and cartilage, for trans-

plantation into humans. It was found that at low temperatures there is a zone of irradiation dosage which lies above that necessary to sterilize, but which is below that which will cause damage to the tissues. When infected organic tissue was reduced to a low temperature and irradiated, using a 3-Mev electrostatic generator which produced high-voltage cathode rays capable of penetrating organic material to a depth of 1.5 cm, bacteria were killed with a high degree of effectiveness, and the substance was found to be still fit for use in medicine and surgery. A report is given of two vascular grafts in humans using aortic grafts preserved in this way, with good results 4 and 6 months postoperatively.

6960

THE EFFECT OF SINGLE MASSIVE DOSES OF ROENTGEN RADIATION UPON THE LIVER. Irving M. Ariel. Radiology 57, 561-75(1951) Oct.

The acute morphological changes in the rabbit's liver following single massive doses of x radiation to that organ were studied. Single doses of 300 to 100,000 r at 90 kv were given and the animals were sacrificed or succumbed at various intervals thereafter. Edema, hyperemia, and leukocytic infiltration were produced in the vascular system. Edema appeared to be most marked in the central portion of the lobule and polymorphonuclear leukocytic infiltration in the portal areas. Liver cells were damaged or destroyed in proportion to the dosage, very high doses causing complete necrosis, while the lower dosages produced only slight swelling of the cells. In the lower dosage range, focal destruction of the liver cells was produced, indicating apparently a variable sensitivity to radiation. Repair was rapid when possible; otherwise death occurred, depending upon the dosage and extent of the damage.

6961

ANIMAL-EXPERIMENTAL INVESTIGATION OF PARENTERAL THORIUM X APPLICATION. Heinz Spiess. Z. ges. expti. Med. 117, No. 6, 567-86(1951). (In German)

The clinical effects on rabbits of intravenous injection of ThX (Ra^{224}) in single or divided doses up to 1000 esu has been studied. The changes in the blood picture are reported, including effects on blood sugars, serum proteins, and serum Ca and P contents. Effects on the kidneys, reproductive system, and metabolism are noted. X-ray photographs and autoradiographs illustrate the localization and damage caused by ThX in bone and cartilage growth and fracture healing.

6962

ALTERATION IN SHAPE AND SIZE OF PLASTICS IN THE PROTHALLIA OF POLYPODIACEAE AND EQUISETACEAE UNDER THE INFLUENCE OF X RADIATION. L. P. Breslavets. Doklady Akad. Nauk S.S.S.R. 78, No. 6, 1235-8 (1951) June 21. (In Russian)

The effects of 15,000 to 120,000 r of x radiation on plastids in the prothallium of the fern Pteris longifolia and of 7500 to 100,000 r on those in the prothallium of the horsetail Equisetum arvense are illustrated.

6963

BIOLOGICAL AND MEDICAL EFFECTS OF RADIATION AT LOW LEVELS. Titus C. Evans. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.60-6.

Generalizations regarding the effects of ionizing radiations on tissues are given. Destruction of vital cells, toxicity of degeneration products, inflammation, and lowered resistance to trauma all contribute to the damage initiated by irradiation. Lymphatic tissue, the bone marrow, epithelium of intestine, skin, and gonads are especially radiosensitive and are affected rapidly by only small dosages of radiation. Effects of radiation intensity upon the body reaction are presented in tabular form. Radiation-sickness syndrome, blood changes, tissue reactions, production of sterility, induction of tumors and cytological and genetic effects of radiation are discussed. (40 references)

6964

EFFECT OF X RADIATION ON WHEAT SEED IN RELATION TO DEGREE OF RIPENESS. O. S. Engel. Doklady Akad. Nauk. S.S.S.R. 78, No. 4, 811-14(1951) June 1. (In Russian)

Data on growth of roots and stalks of wheat sprouts from seed exposed at various stages of ripeness to 500 to 64,000 r of x radiation are tabulated and plotted.

6965

EFFECT OF X-RADIATION ON THE DESOXYRIBONUCLEIC ACID AND ON THE SIZE OF GRASSHOPPER EMBRYONIC NUCLEI. Nyra J. Harrington and Robert W. Koza. Biol. Bull. 101, 138-50(1951) Oct.

Cytological and cytochemical studies were made on embryonic nuclei of the grasshopper, Chortophaga viridifasciata, after x-ray doses of 4000, 10,000 and 12,500 r. The changes induced were photometrically measured by using (1) the Feulgen reaction to determine relative changes in the DNA desoxypentose, and (2) the methyl green stain to indicate the degree of polymerization of the nucleic acid. X-radiation was found to cause swelling of the nuclei. When correction was made for this, the Feulgen-stained nuclei showed no significant loss of DNA after irradiation, but the nuclei stained with methyl green disclosed a highly significant loss of stainability. This is interpreted to indicate that x rays do not destroy the DNA but induce depolymerization of the nucleic acid. This study has shown that it is not safe to make quantitative estimates of DNA (stained by Feulgen or methyl green) from microscopic observations and photographs. The visually apparent loss of Feulgen-stainability after irradiation is probably not due to a decrease in the DNA desoxypentose but rather to the increased dispersion of the DNA in nuclei that have undergone x-ray-induced enlargement. (auth)

6966

ELECTROMAGNETIC RADIATION FUNDAMENTALS AND THEIR APPLICATIONS IN FOOD TECHNOLOGY. Bernard E. Proctor and Samuel A. Goldblith. Advances Food Research 3, 119-96(1951)

Applications of x rays, cathode rays, and radiations from radioactive isotopes in food processing are reviewed; effects of these radiations on bacterial and enzymatic activities and on vitamins are tabulated. Graphs of ultraviolet absorption spectra of food materials after their irradiation are given. 174 ref.

6967

THE EFFECT OF OXYGEN CONCENTRATION ON THE MUTAGENIC ACTION OF MUSTARD GAS. C. Auerbach and J. M. Robson. Experientia 7, 341-2(1951) Sept. 15.

When Drosophila was treated with mustard gas in an atmosphere of either pure O_2 or N the production of mutations by mustard gas proved to be independent of the atmosphere used. Contrasting results obtained with irradiation indicate that O_2 is involved specifically in the production of mutations by x rays.

6968

THE EFFECT OF IONIZING RADIATIONS ON THE BROAD BEAN ROOT. PART IX. CHROMOSOME BREAKAGE AND THE LETHALITY OF IONIZING RADIATIONS TO THE ROOT MERISTEM. J. M. Thoday. Brit. J. Radiology 24, 572-6(1951) Oct.

An investigation of chromosome structural changes produced in Vicia meristems by x and α radiation is reported. Data presented show α rays more efficient, per ionization, in producing chromosome aberrations of all types in Vicia,

than are x rays. The relations between the frequencies of the different types of aberration and dose are presented.

RADIATION HAZARDS AND PROTECTION

6969

Naval Radiological Defense Lab.

RADIUM HAZARD IN A MILITARY AIRCRAFT INSTRUMENT SHOP; FINAL REPORT, (Technical Objective AW-5B); by R. K. Skow, O. J. Sobol, and Willa Wadleigh. June 18, 1951. 20p. (AD-238(H))

A survey of radium contamination in a military-aircraft-instrument shop revealed a degree of contamination greatly in excess of the maximum permitted by AEC standards. The shop had followed the safety regulations of the National Bureau of Standards Handbook H-27. New hazard-control measures are described which, when put into effect after decontamination of the shop, resulted in considerable reduction in the spread of contamination.

6970

Naval Radiological Defense Lab.

INDUSTRIAL FILMS AND RADIOACTIVE CONTAMINATION (Technical Objective AW-5b); by Wesley E. Shelberg and Louis B. Werner. July 9, 1951. 21p. (AD-328(C))

An industrial film is one formed on a surface through contact with various dirts, soils, and industrial wastes, including industrial wastes in the form of smogs. Industrial films and their formation are relevant to radioactive contamination-decontamination phenomena because: (a) Radioactive contaminants will generally encounter surfaces already covered with industrial films; they will rarely, if ever, contact absolutely clean surfaces. (b) Radioactive contaminants from fission bombs resemble aerosol types of atmospheric pollutants, and the behavior and reactions of radioactive mists, dusts, and rains with surfaces may have much in common with the behavior and reactions of smogs with surfaces and consequent industrial film formation. This report summarizes present knowledge concerning smogs and industrial films. No new experimental data are presented. (auth)

6971

Brookhaven National Lab.

CONFERENCE ON "HOT" LABORATORY DESIGN HELD AT BROOKHAVEN NATIONAL LABORATORY ON SEPTEMBER 19, 1947; by Gerald Strickland. [nd] Decl. Oct. 22, 1951. 16p. (AECD-3259; BNL-11)

The status of radiochemical work in 1947 is reviewed. Problems of laboratory equipment, surface decontamination and waste disposal, and personnel protection from radiation exposure are discussed with suggestions for meeting these problems.

6972

CLEANING CONTAMINATED SURFACES. D. H. Ross. Soap Sanit. Chemicals 27, 30-2(1951) July.

A list is made of desirable surface properties for laboratories handling radioactive materials. Efficient detergents are discussed. A maintenance program for a hazard-free nuclear research laboratory is outlined.

6973

ON CERTAIN RESULTS OF CALCULATIONS ON THICKNESS OF PROTECTIVE SHIELDING. A. K. Trapeznikov. Izvest. Akad. Nauk. S.S.S.R. Ser. Fiz. 15, No. 2, 251-7(1951) Mar.-Apr. (In Russian)

The thicknesses of Pb, barytes, and concrete offering satisfactory protection, according to international, British and other standards, against 100- to 1000-kv x rays are plotted and tabulated. 8 references.

6974

DOSAGE CALCULATOR. William C. Orr. Nucleonics 9, No. 5, C10-11(1951) Nov.

A radiation-dosage calculator is described for quick computation of the radiation level in a contaminated area and the total dosage received in such an area in a given period of time, the radiation level having been measured at a certain earlier time. The calculator is based on the approximate decay law $A(t) = ct^{-1.2}$, where -1.2 is the slope of the Way-Wigner decay curve (Phys. Rev. 73, 1318(1948)); A(t) is the dosage rate; t is the time measured from the explosion; and c is an arbitrary constant determined by the first setting of the calculator. The use of the calculator, which consists of one stationary and two movable concentric circular scales, is illustrated by two examples.

6975

DECONTAMINATION CHART. Nucleonics 9, No. 5, C12-15 (1951) Nov.

The results of extensive studies of methods of decontamination are presented in the form of a chart. For each type of surface listed—paint, asphalt, metal, concrete or brick, tile, wood, and soil—several decontaminating materials are compared with respect to type of action, technique to be used, advantages, and disadvantages. Some of the decontaminating agents are water, steam, soapless detergents, complexing agents, trisodium phosphate, organic solvents, caustics, wet sandblasting, vacuum blasting, and vacuum cleaning.

6976

SURVEY METERS FOR WATER MONITORING. J. B. Hursch, S. Zizzo, and A. H. Dahl. Nucleonics 9, No. 5, C16-20(1951) Nov.

This is a shortened version of UR-180, NSA 5-5505. A procedure is described for monitoring water contaminated by fission products. Six commercially available instruments of the thin-side-wall, G-M tube, β-γ survey type were found to be usable. A measurement kit, including calibration standards, has been assembled and is described.

6977

WHAT IS RADIATION? Henry J. Gomberg. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.29-34.

The nature of radiation is discussed from the standpoint of establishing a sound basis of judgment so that a reasonable and intelligent analysis can be made of new situations involving radioactivity as they arise. Types of radiation and methods for protection are described. Radiation is defined as "energy in transit from here to there in the form of electromagnetic waves."

6978

UNITS OF RADIATION AND RADIOACTIVITY. Elda E. Anderson. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.45-7.

The importance of establishing units of measurement for radiation and radioactivity is stressed and the various units are discussed. Methods of measurement of x and γ radiation are presented fully and maximum permissible tissue doses are defined.

6979

PUBLIC HEALTH ASPECTS OF ATOMIC POWER INSTALLATIONS. Lyle B. Borst. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.16.

A summary of precautions taken to ensure safe operation of the Brookhaven reactor is presented. The great need for public health men to acquire radiological training and the

ability to differentiate between real and imaginary radiation hazards is stressed.

6980
QUANTITATIVE LIMITS OF PERMISSIBLE EXPOSURE OF PERSONNEL (EXTERNAL AND INTERNAL). K. Z. Morgan. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.67-76.

Factors determining radiation damage to man, methods of calculating external exposure, maximum permissible levels of external exposure, establishment of maximum permissible levels, hazards of internal radiation exposure, methods by which radioisotopes enter the body, and factors that determine damage are summarized. Classifications of radioisotopes and maximum permissible concentrations as determined by the Subcommittee on Safe Handling of Radioactive Isotopes of the U. S. X-ray and Radium Protection Committee are given. Equations for calculating the maximum permissible amount of a radioisotope in the body are given. A brief discussion of the hazards of radiological warfare and procedures to be followed in the event of an atomic attack is also included.

6981
BASIC PRINCIPLES OF RADIATION PROTECTION. Elda E. Anderson. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.77-9.

Basic principles of radiation protection are reviewed in the light of 8 yr of reactor operation with an excellent safety record. External and internal radiation hazards and methods of protection against them are discussed. Recognition of radiation as a permanent part of modern science which will become increasingly important in industry, in medicine, and in the day-to-day experiences of men is stressed. It is pointed out that if protection is to keep pace with the increased use of radiation sources, the existing knowledge of radiation protection must be applied on an ever-widening scale.

6982
PROTECTION IN MEDICAL RADIOLOGY. Fred Jenner Hodges. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.98-102.

The code of standards dealing with physical facilities, medical practices, and administration of medical radiology in hospitals set up by the American Hospital Association is discussed. The conversion of 1000 ft^2 of hospital floor space to provide x-ray facilities is described to illustrate the principles.

6983
PROTECTION IN USE OF RADIOISOTOPES — LOW AND INTERMEDIATE LEVELS. George G. Manov. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.103-10.

Basic principles of protection against both external and internal radiation, safe handling techniques, and methods for surveying and detection of contamination are discussed.

6984
DISPOSITION OF RADIOACTIVE SOURCES. C. C. Ruchhoft. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.111-14.

Criteria for handling and disposal of radioactive wastes in the form of solids, liquids, gases, and aerosols are given.

6985
RADIOLOGICAL HEALTH. Edwin G. Williams. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.126-8.

Recommendations for establishment of a community-wide program designed to acquaint the public with facts relating to the health aspects of radiation are given. Responsibilities of public health officers for control of radiation hazards are discussed.

6986
SKIN CONTAMINATIONS BY RADIOACTIVE SUBSTANCES. MEANS OF PROTECTION AND DECONTAMINATION. P. Genaud. J. radiol. électrol. 32, No. 5-6, 498-503(1951)

Some 20 different procedures for decontamination of the skin after handling of radioactive tools were tried out, none was found perfect, brushing with soap seemed to be most effective. Usage of certain protective coatings gives considerable protection.

6987
COSMIC RAYS AND THEIR RADIATION-BIOLOGICAL ACTION. E. Schopper. Röntgen Blätter 4, 224-36(1951) Sept. (In German)

The nature and intensity of cosmic-ray components are reviewed, and the specific ionization of particles of various energies are compared with the equivalent dose of cosmic radiation, the data being taken from the literature. A definite hazard would be expected to exist in space for the larger terrestrial creatures in whose bodies the secondary radiation could reach its maximum. Effective protection would be offered by at least 1 to 2 m of water equivalent.

6988
THE SLOW NEUTRON-INDUCED RADIOACTIVITIES OF NUCLEAR EXPLOSIONS. C. E. Mandeville. J. Franklin Inst. 252, 297-308(1951) Oct.

The slow-neutron-induced radioactivities of nuclear explosions have been evaluated for infinite media of filtered Schuylkill water and the earth's crust. The magnitudes of these effects are compared with the activity of the fission fragments, and the conditions under which they may be of importance are considered. It has been assumed that a gram-molecule of neutrons is liberated in the blast.

6989
RADIOACTIVE CONTAMINATION AND ITS HAZARDS IN WORK WITH RADIOINDICATORS. H. Götte. Angew. Chem. 63, 434-7(1951) Sept. 21. (In German)

The ease of contaminating the immediate working area or the entire laboratory during various radioactive tracer investigations is stressed. Proper experimental techniques for handling solutions, volatile substances, etc., are discussed.

RADIATION SICKNESS

6990
PARTIAL OR COMPLETE PELVIC EXENTERATION FOR EXTENSIVE IRRADIATION NECROSIS OF PELVIC VISCERA IN THE FEMALE. Alexander Brunschwig. Surg. Gynecol. Obstet. 93, 431-8(1951) Oct.

Ten cases are described in which partial or complete pelvic exenteration was performed for advanced necrosis of viscera in the pelvis due to irradiation. Hospital mortality was 40%.

6991
ACUTE RADIATION INJURIES IN MAN. Louis H. Hempelmann. Surg. Gynecol. Obstet. 93, 385-403(1951) Oct.

A review of the biological reactions produced by ionizing radiation and types of radiation injury is followed by four

case histories taken from the files of the Los Alamos Scientific Laboratory and the Los Alamos Hospital. The four cases include one case of acute localized injury and three cases of acute generalized radiation injury. The symptoms and treatment of each case are described in detail, but greater detail can be found in Los Alamos reports LA-1095, 1096, and 1097. 31 references.

RADIOTHERAPY

6992

MEDICAL APPLICATIONS OF RADIATIONS AND RADIOACTIVITY. Isidore Lampe. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.85-90.

Several diagnostic tests using radioisotopes for tracer techniques are discussed and the importance of radioisotopes in contributing to diagnostic methods of the future is postulated. Radiotherapy in cancerous and noncancerous diseases is discussed. The author points out that at the present time the field of therapy with radioisotopes is at a low level of accomplishment due to inability to produce sufficient concentrations of radioactive elements in abnormal tissue.

6993

PRACTICAL ASPECTS OF RADIOACTIVE ISOTOPES IN RELATION TO MEDICAL TREATMENT. Joseph S. Mitchell. Brit. Med. J., 748-57(1951) Sept. 29.

Artificial radioisotopes of value in practical medicine methods of their applications and results of treatment are reviewed in some detail, including P^{32}, indicated for treatment of polycythemia, I^{131} for some thyroid diseases, N^{24} for some blood diseases, Au^{197} and Au^{198} for treatment of small tumors and tumors of lymph nodes, Co^{60} and Ir^{192} for teletherapy, and intraactive irradiation with sources in solution. 80 ref.

6994

OBSERVATIONS ON BETATRONS, SYNCHROTRONS AND ELECTRON ACCELERATORS. P. Lamarque. J. radiol. électrol. 32, No. 5-6, 491-3(1951)

The different types of electron accelerators and their possible advantages for radiotherapy are discussed, with the conclusion that in order to improve our known radiotherapeutic technique usage of far more than 20 to 30 Mev is needed. General use of these devices awaits further research.

6995

RADIOTHERAPY OF POLYCYTHEMIA BY RADIOPHOSPHORUS. Wolfgang Horst and Heinrich Sauer. Deut. med. Wochschr. 76, 1237-41(1951) Oct.

Five case histories of treatment of polycythemia with P^{32} are given, showing that its use is preferable to whole-body x irradiation; radiation sickness does not result and thrombosis occurrence is decreased. The general decrease of blood volume caused by use of P^{32} is of advantage to patients with faulty circulation and cures of long duration result. Observed complications in the blood picture are of short duration and not considered dangerous.

6996

RADIOACTIVE IODINE AS AN ADJUNCT TO THE SURGICAL MANAGEMENT OF DISEASES OF THE THYROID. Brown M. Dobyns. Surg. Gynecol. Obstet. 93, 415-27(1951) Oct.

The practical applications of radioactive iodine in certain clinical circumstances in which uncertainties handicap the surgical management of thyroid disease are reviewed. The general principles and the physiological considerations which underlie their application in Graves' disease, nodular goiter, and carcinoma of the thyroid are discussed. 26 references.

6997

PRESENT DAY RADIOTHERAPEUTICAL PROBLEMS. A. Heroe. Rev. méd. Liége 6, 651-60(1951) Oct.

The utilization of the discoveries of modern radiation physics in radiotherapy are discussed; it is concluded that to date not much improvement has been made in the prognosis of tumors even though constant improvement of electrical apparatus has simplified techniques and improved precision. Examples of use of ionizing radiation in cell physiology of carcinogenesis and of uses of chemical agents for protection against radiation injuries are discussed, showing the progress made in these fields.

TOXICOLOGY STUDIES

6998

Imperial Chemical Industries, Ltd., Widnes (England)
TOXICITY OF URANIUM IN INDUSTRIAL PROCESSES; by J. S. Mitchell and A. Thelwall Jones. Sept. 11, 1945. 3p. (BR-644A)

TRACER APPLICATIONS

6999

Brookhaven National Lab.
ETHANOL FORMATION IN PSEUDOMONAS LINDNERI; by Martin Gibbs and Ralph D. DeMoss. [nd] 5p. (BNL-1016)

The results of C^{14} glucose fermentation by Pseudomonas lindneri show that carbon atoms 1, 2, and 3 of glucose yield carbon dioxide (carbon atom 1) and ethyl alcohol (carbon atoms 2 and 3) via a fermentative Zwischenferment mechanism while carbon atoms 4, 5, and 6 yield carbon dioxide (carbon atom 4) and ethyl alcohol (carbon atoms 5 and 6) via the Embden-Meyerhof-Parnas glycolysis scheme.

7000

IODINE IN THE ATOMIC AGE. George M. Curtis. J. Am. Pharm. Assoc., Sci. Ed. 40, 479-87(1951) Oct.

Data are given on the metabolism of I as related to nutrition as well as to thyroid function in health and disease, and on results of application of I^{131} in tracer studies and radioautography. 32 references.

7001

BIOLOGICAL APPLICATIONS OF RADIOISOTOPES. S. Allan Lough. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.80-4.

Applications of tracer techniques in biology and methods for both qualitative and quantitative estimation of radioisotopes by means of isotope dilution analysis are discussed. Examples of tracer techniques in a study of plant-growth regulators, a study of the fructification of peanuts, tracing the absorption of barium sulfate and zirconium dioxide in dogs, the uptake of calcium by the skeleton, the effect of drugs on iodine uptake by the thyroid, and studies of the distribution of antihistaminics in tissues are presented.

7002

IN VIVO STUDIES WITH RADIOISOTOPES. Enrique Strajman and Nello Pace. pp. 193-241 in Advances in Biological and Medical Physics, Vol. II. New York, Academic Press, Inc., 1951.

Part I of this review includes sections on analysis of the factors involved in in vivo studies, instrumentation, and determination of the radioisotope concentration in tissue. Part II reviews the results obtained by application of the in vivo method to the study of various biological problems. 152 references.

7003

THEORETICAL ASPECTS OF ISOTOPES IN RELATION TO MEDICINE. A. Wormall. Brit. Med. J., 757-62(1951) Sept. 29.

Radioisotopes, their properties, preparation, and advantages and disadvantages of their use in tracer techniques in immunity and chemotherapy studies are reviewed.

7004
THE USE OF I^{131} RED CELL PLASMA RATIO AS A MEASURE OF THYROID FUNCTION. Kenneth G. Scott, James C. Reavis, Wm. W. Saunders, and William E. White. Proc. Soc. Expti. Biol. Med. 76, 592-5(1951).

The ratio of red cell space for inorganic iodine to that of plasma was found to be about 0.5, in both in vitro and in vivo studies. The initial red cell-plasma ratio was the same in hyperthyroid, euthyroid, and hypothyroid patients immediately after the oral administration of a test dose of I^{131}. The ratio dropped as the inorganic iodine test dose was incorporated into larger molecules by the thyroid and returned to the blood stream. The drop in red cell-plasma ratio was due to the relative impermeability of the red cell to large iodine-containing molecules. The rate of drop of the red cell-plasma ratio is an expression of thyroid activity. (auth)

CHEMISTRY

7005
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
NUCLEAR CHEMISTRY (INORGANIC) GROUP, p.19-29 of PROGRESS REPORT; JANUARY 1, 1951. 11p. (NP-3437 (p.19-29))

The compound tetrakistrichlorophosphine nickel, $Ni(PCl_3)_4$, has been prepared in large quantities by direct action in the liquid phase of PCl_3 on $Ni(CO)_4$. The method of preparation and physical properties are described. A study was made of the influence of resin particle size and applied voltage on the electrolysis of the sodium form of the ion-exchange resin Dowex-50 (NaR). Both the mobility of the ions and the gradual spread of a radiosodium-tagged band were measured by the radiotracer technique. The conductivity of the resin increased as electrolysis progressed. Measurements with current held constant showed that H ions had penetrated the radiosodium layer and slowed down its movement by virtue of competition by their higher mobility. The results of the ion-exchange experiments are tabulated. A new Sb isotope (probably Sb^{128}) with a half life of 1.1 hr has been found after a long irradiation of UO_3. The Sb isotopes in this region with their fission yields are 99-hr Sb^{127}, 0.08%; 1.1-hr Sb^{128}, 0.1%; 4.6-hr Sb^{129}, 0.2%; 23.1-min Sb^{131}, 1.5%; 4.4-min Sb^{133}, 3.8%. The relative yields of 13.8-hr Zn^{69m} and 52-min Zn^{69} have been determined as a function of deuteron energy for the nuclear reactions $Zn^{68}(d,p)Zn^{69}$ and $Ga^{71}(d,\alpha)Zn^{69}$. The value of the ratio of the cross sections $\sigma_{52\ min}/\sigma_{13.8\ hr}$ as a function of deuteron energy for these two nuclear reactions is plotted.

7006
Radiation Lab., Univ. of Calif.
THE VAPOR PRESSURE OF GERMANIUM; by Alan W. Searcy. Sept. 1951. 10p. (UCRL-1403)

The vapor pressure of liquid germanium has been determined over a 370° range by the Knudsen effusion method. The data lead to the equation $\Delta F = 88{,}400 + 2.00\ T \ln T - 46.0\ T$ for vaporization of liquid germanium. Estimated heat data lead to a value of 85.2 ± 1.5 kcal for the heat of sublimation of germanium at 298.15°K. Germanium vapor is demonstrated to react with a platinum plate heated to about 700°K. (auth)

7007
Towne Scientific School, Univ. of Pa.
THERMODYNAMIC STUDY OF IRON-OXYGEN-SULFUR SYSTEM; ANNUAL REPORT; by F. J. Dunkerley, J. L. Nichols, and V. V. Damiano. Oct. 1, 1951. 7p. (NYO-734)

Progress is reported in the thermodynamic study of the iron-sulfur-oxygen system. Preliminary results show that when SO_2 having a partial pressure of 9.032×10^{-5} atm. is passed over molten Fe having a high S content (0.401%), an increase in reaction is observed with increasing temperatures. A plot of $\frac{(FeS)\ (FeO)^2}{PSO_2}$ vs. 1/T gives a straight line indicating a constant heat of reaction in this temperature range.

7008
ANOMALOUS VALENCES. Wilhelm Klemm. Angew. Chem. 63, 396-402(1951) Sept. 21. (In German)

Developments during the last decade in the preparation of previously unobserved oxidation states of Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Ag, B, Al, Si, and the alkali and alkaline-earth metals are reviewed. The problem of the structure of compounds of graphite, Si, and Ge with K, Rb, and Cs is touched on.

ANALYTICAL PROCEDURES

7009
Knolls Atomic Power Lab.
PRECISION SPECTROSCOPIC ANALYSIS OF DEUTERIUM AND AIR IN HYDROGEN-DEUTERIUM-AIR-MIXTURES; by H. P. Broida and G. H. Morgan. Sept. 10, 1951. 72p. (KAPL-599)

Further investigations of a method of analysis of hydrogen-isotope mixtures described in KAPL-502 were made to determine optimum operating conditions and to study the variations of relative intensity of the isotope lines with various parameters. The precision of measurement of the major component has been increased to 0.02%, the day-to-day reproducibility to 0.07%, and the absolute accuracy, limited by the lack of standard samples, to 0.35%. With a molecular-nitrogen band as a monitor, it has been found that air impurities up to 6% can be measured to within 0.1% and that air impurities up to 50% do not affect the relative intensities of the isotope lines. With a 150-Mc electrodeless discharge, a flowing-gas system, and a high-resolution grating spectrometer, the effects of various parameters, including intensity, pressure, added air, flow rate, discharge-tube diameter, and length of emitting path, have been studied in detail. Effects of type of discharge cooling, removal of solid CO_2 traps, variation of slit widths, and the use of various Balmer transitions have also been investigated. The small effect of pressure on the measured concentration has been confirmed, and it has been found that the measurement depends slightly upon the particular Balmer transition. Possible causes for these effects are discussed and suggestions are included for simplification of the apparatus.

7010
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

CHEMISTRY OF THE FISSION ELEMENTS GROUP, p.1-5 of PROGRESS REPORT; JANUARY 1, 1951. 5p. (NP-3437 (p.1-5))

Different methods for the determination of complex-ion formula and stability constants in the lead nitrate systems have been compared. The formation constant of the lead mononitrate complex ion at an ionic strength of 2.00 was found to be 1.0 by polarographic means, and in the range of 2 to 3 by both emf and spectrophotometry measurements. In investigations of variables affecting the electrodeposition behavior of fractional monolayers of Ag on inert surfaces, it has been demonstrated that, although the behavior can be changed by igniting an electrode, the preignition behavior will be regained by repeated anodic polarizations of the electrode. The behavior of traces of Ag was found to remain unaffected in the presence of amounts of Pt, Pd, or Cu as great as 10^{-2}M. In the study of the coulometric determination of submicrogram amounts of Ag, calibration curves have shown that over a period of 3 to 6 months the efficiency with which the Ag can be stripped from a particular electrode gradually decreases from 100% to about 60%. A decrease in the residual current obtained in a "blank" determination has also been observed. A new set of calibration curves must be prepared at regular intervals to ensure maximum accuracy with the method.

7011

Radiation Lab., Univ. of Calif.

PROPIONIC ACID METABOLISM IN MOUSE LIVER SLICES; by L. Daus, M. Meinke, and M. Calvin. Sept. 1951. 20p. (UCRL-1476)

The metabolytes from propionic acid metabolism in mouse liver slices were studied using methods of chromatography for isolation and identification. Degradation data showed randomization between the α and β carbons of the lactic acid which was formed. When β-labeled propionate was the incubation substrate, the activity in the resulting β-hydroxyvaleric acid was principally in the γ position and the β and Δ positions were inactive. (auth)

7012

Ames Lab.

SPECTROPHOTOMETRIC DETERMINATION OF CERIUM; by R. E. Edwards, A. S. Ayers, and C. V. Banks. Aug. 31, 1951. 7p. (ISC-165)

An ultraviolet spectrophotometric method for the determination of Ce utilizes the reaction of a Ce solution with H_2O_2 in ammoniacal solution with citric acid as the complexing agent. The method is rapid and accurate, but suffers from many interferences, which may be eliminated by the use of a preliminary separation with oxalic acid. Apparatus and reagents are described and the recommended procedure is presented in detail. Results obtained on samples to which varying amounts of interfering ions were added are tabulated.

7013

SPECTROSCOPIC DETERMINATION OF VANADIUM IN RESIDUAL FUEL OILS. J. W. Anderson and H. K. Hughes. Anal. Chem. 23, 1358-61(1951) Oct.

A spectroscopic technique for V determination is described which should be applicable to any powdered inorganic sample containing at least 1% V. A Ti internal standard and a matrix of silica and graphite were used. Out of 42 duplicate determinations, three had to be repeated; of the remaining 39, the average deviation from mean values was 4%.

7014

DETERMINATION OF LANTHANUM IN RARE EARTH MIXTURES. F. T. Fitch and D. S. Russell. Anal. Chem. 23, 1469-73(1951) Oct.

La was separated from other rare-earth elements by selective retention on a cation-exchange bed during elution with hydrazinodiacetic acid. The La was removed from the resin by a solution of 1% nitrilotriacetic acid–2% NH_4Cl at pH 7.5 to 8.0 and determined gravimetrically by precipitation with oxalic acid.

7015

RADIOACTIVE TRACERS IN PAPER PARTITION CHROMATOGRAPHY OF INORGANIC IONS. W. Joe Frierson and John W. Jones. Anal. Chem. 23, 1447-52(1951) Oct.

An effort has been made to develop techniques in the use of radioactive elements in order to enlarge the usefulness of inorganic paper chromatography. A device for scanning paper chromatograms is described. Radioactive tracers have been found useful for locating and identifying an element. The techniques for identification may be based on decay and growth, energy of radiation, and type of radiation. They have been applied to the identification of radiochemical impurities, and they are useful in locating and identifying the elements on a paper chromatogram, especially when there is no satisfactory reagent for identifying small amounts of the ions on paper and the ions are not well separated. The application of the technique to the following combinations of elements is described: Na-K, Ti-Sc, Fe-Co, Fe-Ni-Zn, Mn-Zn, and Pb-Bi-Po.

7016

THE SPECTROGRAPHIC DETERMINATION OF HAFNIA IN MIXTURES OF HAFNIUM AND ZIRCONIUM OXIDES. G. W. J. Kingsbury and R. B. Temple. J. Applied Chem. 1, 406-11(1951) Sept.

The application of a general method for quantitative analysis of nonconducting solids to the determination of hafnium oxide in mixtures of hafnia and zirconia over the concentration range 0.01 to 55% is described. The material to be analyzed is attached to the end of flat graphite electrodes by a drop of Bakelite varnish and excited by means of a new type of impulse arc. Not more than 10 mg of the oxides is required. Good results have been obtained with two-line pairs: Zr I 2647.8 A, Hf II 2641.406 A, between 0.01 and 1% HfO_2; Zr 2545.6 A, Hf II 2548.2 A, between 1 and 50% HfO_2.

7017

ON THE DETERMINATION OF BERYLLIUM AS PYROPHOSPHATE. Rino Airoldi. Ann. chim. 41, 478-90(1951) Nov. (In Italian)

A critical survey is made of the literature dealing with the determination of Be as pyrophosphate, and an attempt is made to reconcile the discrepancies among results obtained by the various methods. Consideration is given to factors which alter the accuracy of the analytical methods. It is concluded that the best procedures are those of Cupr (Z. anal. Chem. 76, 173(1929)) and Gadeau (Rev. mét. 32, 398(1935)), the latter being acceptable only when the filtration of the phosphate is carried out at a pH not less than 5.5.

7018

DETERMINATION OF BISMUTH IN TUNGSTEN ORES. C. L. Sollenberger and Janis Smith. Anal. Chem. 23, 1490-1 (1951) Oct. (Note)

The pulverized sample was digested in HNO_3, filtered, and diluted with distilled H_2O. Sodium sulfite and KI were added, and the color of the resulting solution was compared with a standard with an electrophotometer. This procedure was used for samples varying from 0.03 to 60% Bi.

7019

APPLICATION OF AN ALUMINUM WEDGE TO QUANTITATIVE X-RAY SPECTROGRAPHY WITH A BENT CRYSTAL. I. G. Dem'yanikov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz., 15 No. 2, 239-42(1951) Mar.-Apr. (In Russian)

X-ray spectrographic data taken while quantitatively analyzing mixtures of Zr and Y oxides of known ratio by this method are tabulated.

7020
DETERMINATION OF FREE CARBON IN BORON CARBIDE. G. A. Meerson and G. V. Samsonov. Zavodskaya Lab. 16, 1423-8(1950) Dec. (In Russian)

Investigation of the velocity of oxidation of B_4C in various degrees of granulation by O_2 and CrO_3 mixtures established that this velocity is constant with respect to temperature. On the basis of this regularity a method for the determination of free C in B_4C, using the difference between B_4C and graphite in rate and character of oxidation, is proposed.

7021
ANALYSIS OF URANIUM AND THORIUM BY COUNTER METHOD. F. Běhounek. Collection Czechoslov. Chem. Communs. 15, 699-707(1950)

A method for determining the U and Th content of rocks and low-grade ores by the counting of γ rays from Ra(B + C) (Pb^{214} and Bi^{214}) and Th(B + C) (Pb^{212} and Bi^{212}), respectively, is described. Concentrations as low as 1×10^{-6} g U/g and 1.86×10^{-6} g Th/g can be determined with a probable error of 15%. Methods of determination of U and Th in samples containing a mixture of the two elements are discussed. A simple differential counting method based on the self-absorption of γ rays in the sample is indicated for distinguishing low-grade ores containing either U or Th. (auth)

7022
TITRIMETRIC DETERMINATION OF SMALL AMOUNTS OF THORIUM IN THE PRESENCE OF URANIUM. Vl. Majer and M. Cejpová. Collection Czechoslov. Chem. Communs. 15, 875-80(1950).

The following procedure was used for determination of Th in the range 0.3 to 30 mg of ThO_2 in the presence of U. Thorium oxalate was precipitated from a hot acid solution with a saturated solution of oxalic acid. The solution with the precipitate was left overnight at room temperature. The precipitate was filtered, washed, and dissolved in H_2SO_4, and the solution titrated with $KMnO_4$. The procedure is suitable for routine analyses.

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

7023
THE TWELVE ARTIFICIAL ELEMENTS AND THE NEW PERIODIC SYSTEM. Luis Hurtado Acera. Ion 11, 448-52, 464(1951) Aug. (In Spanish)

A new periodic table is proposed and explained. It consists of eight groups according to the level in which the characterizing electron is situated, plus another group for the noble gases. The rare earths do not require a separate category. The method and date of first preparation, number of isotopes known, and proposed names of the twelve artificial elements are discussed.

7024
MENDELEEV'S PERIODIC SYSTEM OF THE ELEMENTS AND CERTAIN PROBLEMS OF ATOMIC PHYSICS. I. P. Selinov. Uspekhi Fiz. Nauk 44, No. 4, 511-26(1951) Aug. (In Russian)

A 1951 edition of the periodic table is given. Electron configurations, stable isotopes, and radioactive isotopes with their mode of decay are shown on the chart. The problem of the upper limit of the periodic system is discussed.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

7025
X-RAY ANALYSIS OF UNALIGNED CRYSTALS. M. M. Umanskiĭ and S. S. Kvitka. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 15, No. 2, 147-56(1951) Mar.-Apr. (In Russian)

Various x-ray-diffraction cameras and techniques used to determine the structure of crystals without first aligning the crystal along an axis are illustrated. Cell constants of monoclinic $Pr_2(SO_4)_3.8H_2O$, $Nd_2(SO_4)_3.8H_2O$, and $Sm_2(SO_4)_3.8H_2O$ have been determined.

7026
STRUCTURE INVESTIGATION OF CERTAIN COMPOUNDS OF THE RARE EARTH ELEMENTS. V. I. Iveronova, V. P. Tarasova, and M. M. Umanskiĭ. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 15, No. 2, 164-9(1951) Mar.-Apr. (In Russian)

Cell constants and other structural information, determined experimentally, are given for hexagonal $La_2(SO_4)_3.9H_2O$, monoclinic $Pr_2(SO_4)_3.8H_2O$, $Nd_2(SO_4)_3.8H_2O$, $Sm_2(SO_4)_3.8H_2O$, $NdCl_3.6H_2O$, and $SmCl_3.6H_2O$, and triclinic $La(NO_3)_3.6H_2O$, $LaCl_3.nH_2O$, and $PrCl_3.nH_2O$.

7027
THE NATURE OF THE SECOND-ORDER TRANSITION IN ND_4Br. Henri A. Levy and S. W. Peterson. Phys. Rev. 83, 1270-1(1951) Sept. 15. (Letter to the editor)

Complete crystal-structure determinations have been made by means of neutron diffraction, of the room-temperature and low-temperature (−195°C) phases of ND_4Br. Observed and calculated data are tabulated for comparison. The phase at −195°C was found to give a simple cubic pattern with $a_0 = 3.96$ A. In room-temperature ND_4Br there exists orientational disorder of the ammonium ions, and the crystal belongs to symmetry class O_h, simulating the space-group symmetry O_{h^1}. The data support the hypothesis that second-order phase transitions in the ammonium halides can be interpreted as the onset of orientational disorder of ammonium ions. The length of the N−D link for both phases is 0.99 ± 0.02 A.

DEUTERIUM AND DEUTERIUM COMPOUNDS

7028
KINETICS OF THE EXCHANGE REACTION BETWEEN DIBORANE AND DEUTERIUM. P. Calvin Maybury and W. S. Koski. J. Chem. Phys. 19, 1327(1951) Oct.

Recent investigations indicate deuterium-diborane exchange proceeds through a complex involving BH_3. Experimental results appear to be compatible with the following series of reactions representing the mechanisms of the exchange: (1) $B_2H_6 \rightleftharpoons 2BH_3$; (2) $BH_3 + D_2 \rightarrow BH_2D_2$; (3) $BH_2D_2 + B_2H_6 \rightarrow B_2H_5D + BH_3 + HD$. The first two reactions are considered to be rapid and the last reaction is the rate determining step. Equation (2) suggests that the presence of inert diatomic gases may influence the rate of the exchange.

FLUORINE AND FLUORINE COMPOUNDS

7029
DETERMINATION OF THE TWO-DIPOLE MOMENT COMPONENTS IN NITROSYL FLUORIDE. Dale W. Magnuson. J. Chem. Phys. 19, 1071(1951) Aug. (Letter to the editor)

The dipole-moment components along the least and intermediate principal inertial axes, μ_a and μ_b, have been determined for nitrosyl fluoride by means of the Stark effect in pure rotational transitions. These are $\mu_a = 1.70$ and $\mu_b = 0.62$ Debye units, which together give $\mu = 1.81$ Debye units. Preliminary calculations of the molecular configuration of nitrosyl fluoride, using, in addition, microwave data on $N^{15}OF$, are N−F = 1.52 A, N−O = 1.13 A, and ∠ONF = 110°. The only reasonable orientation of the dipole moment μ is $\mu_{NF} = 1.75$, $\mu_{NO} = -0.17$. A discrepancy is noted between this N−F dipole moment and that in nitrogen trifluoride, 0.18 Debye unit. (See also NSA 5-5097.)

7030

INFRARED SPECTRA OF EIGHTEEN HALOGEN-SUBSTITUTED METHANES. Earle K. Plyler and W. S. Benedict. J. Research Natl. Bur. Standards 47, 202-20 (1951) Sept.

In order to study how the vibrational frequencies of methane vary with halogen substitutions, the infrared spectra of the following halogen-substituted methanes have been studied with a prism spectrometer between 2 and 38 microns: Carbon tetrafluoride, chlorotrifluoromethane, dichlorodifluoromethane, trichlorofluoromethane, carbon tetrachloride, trichlorobromomethane, dichlorodibromomethane, fluoroform, difluorochloromethane, dichlorofluoromethane, chloroform, dichlorobromomethane, chlorodibromomethane, bromoform, iodoform, methylene fluoride, methylene chloride, and methylene iodide. Spectra are presented as obtained at room temperature in the vapor and liquid states, and in a few cases in solution. The bands are interpreted as fundamentals, overtones, combination, and difference bands. Tables and graphs display the regularities existing among the various fundamentals of these molecules and other halogen-substituted methanes. Force-constant calculations, using an approximate potential function with general constants transferred from one molecule to another are reported. (auth)

7031

NOTE ON A B-FLUORINATED BORAZOLE. Egon Wiberg and Gabriele Horeld. Z. Naturforsch. 6b, No. 6, 338-9(1951) Aug.-Sept. (Note; in German)

Dimethyl boron fluoride, $(CH_3)_2BF$, and methylamine react by way of various insoluble imtermediates to form colorless, crystalline B-trifluoro-N-trimethylborazole, $(BFNCH_3)_3$, m.p. 85°C, b.p. 224°C. In analogous fashion the reaction of $(CH_3)_2BF$ and CH_3BF_2 with NH_3 and amines leads to B-fluorinated borazanes ($(CH_3)_2BF.NH_3$, m.p. 51°C; $(CH_3)_2BF.NH(CH_3)_2$, m.p. 21°C; and $(CH_3)_2BF.N(CH_3)_3$, m.p. 33°C) and B-fluorinated borazenes ($CH_3BF:NHCH_3$), b.p. 46°C; and $CH_3BF:N(CH_3)_2$, b.p. 58°C). All the B-fluorinated borazenes show a great tendency to polymerize.

7032

SOME PROPERTIES OF PERFLUOROCARBOXYLIC ACIDS. E. A. Kauck and A. R. Diesslin. Ind. Eng. Chem. 43, 2332-4(1951) Oct.

Fully fluorinated acid fluorides were produced by electrolysis of the corresponding hydrocarbon acids or anhydrides in hydrogen fluoride. The acid fluorides thus formed were hydrolyzed to the corresponding perfluoro acids. Boiling points and liquid densities are presented for the following acids: perfluoroacetic, perfluoropropionic, perfluorobutyric, perfluoroisobutyric, perfluorovaleric, perfluorocaproic, perfluoroheptanoic, perfluorocaprylic, perfluorocapric, perfluoromyristic, perfluorocyclohexanecarboxylic, and perfluorocyclohexaneacetic. With the exception of the first three compounds listed these substances are reported for the first time. Data are presented on vapor pressure, viscosity, pH, and equivalent conductance of perfluoroacetic and perfluorobutyric acids.

GRAPHITE

7033

Knolls Atomic Power Lab.

THE SYMMETRY OF GRAPHITE; by Joseph S. Lukesh. [nd] 4p. (AECU-1674)

A schematic representation of the c axis, zero level of the reciprocal lattice of graphite showing the array of satellite reflections is presented. The satellites are separated from their parent reflections by one-fifteenth of the reciprocal a axis. The separation doubles and then triples in the direction of the reciprocal b axis.

7034

THERMOELECTRIC POWER OF CARBONS AND GRAPHITE. Egon E. Loebner. Phys. Rev. 84, 153(1951) Oct. 1. (Letter to the editor)

A study has been made of the thermoelectric power of C and of graphite at room temperature. The dependence of thermoelectric power upon heat-treatment between 700 and 3000°C was investigated, and the results of measurements on petroleum coke products are plotted. A limiting value of −4.5 microvolts/°C was observed for a Ceylon graphite piece which was made by compressing highly purified Ceylon graphite powder. The negative thermoelectric effect for graphite shows a higher mobility for electrons than for holes. The origin of the thermoelectric power is discussed in terms of electronic conductivity.

LABORATORIES AND EQUIPMENT

7035

Department of Mines and Technical Surveys (Canada)

RADIOASSAY OF URANIUM ORE WITH THE GEIGER TYPE EQUILIBRIUM COUNTER; by R. D. Wilmot and C. McMahon. 58p. (NP-3446)

Information on the physical assay of radioactivity has been compiled for those interested in providing their own facilities for determining U contents. The basic theory of the method, apparatus required, details of the assay procedure including sample preparation, standards, calibration and sample calculations, and qualifications of personnel are discussed. A glossary of commonly used terms in radioactivity is included.

7036

Northwestern Univ.

A GRAVIMETRIC METHOD FOR THE CALIBRATION OF HEMOGLOBIN MICROPIPETTES; by George F. Stevenson, George W. Smetters, and John A. D. Cooper. [nd] (AECU-1482)

The tip of a tuberculin syringe and the base of the pipet to be calibrated are fitted tightly into opposite ends of a one-hole rubber stopper, and the whole assembly is clamped to a retort stand so that the pipet is in a vertical position. Hg is drawn into the pipet up to the 20-mm^3 mark by withdrawing the plunger of the syringe. The Hg is weighed and the volume is calculated. The accuracy of the procedure is comparable to that of the standard gravimetric method of calibration employed in most hospital laboratories.

MOLECULAR STRUCTURE

7037

NUCLEAR MAGNETIC SHIELDING IN FLUORINE AND HYDROGEN COMPOUNDS. H. S. Gutowsky and C. J. Hoffman. J. Chem. Phys. 19, 1259-67(1951) Oct.

Measurements of the nuclear magnetic shielding of F^{19} and H^1 are reported for a number of their respective binary covalent compounds. The applied fields required for the F^{19} and H^1 nuclear magnetic resonances, at fixed frequency, vary in these compounds over a range of 3.98 and 0.122 gauss, respectively, at fields of about 6365 gauss. These ranges are of the same order of magnitude as the theoretical internal diamagnetic corrections for the unbound fluorine and hydrogen atoms. The dependence of nuclear magnetic shielding on the electronic structures of the molecules is discussed qualitatively and some general correlations are indicated. The tetragonal pyramid structure for IF_5 is confirmed and a similar structure demonstrated for BrF_5. The appearance of double F^{19} resonance lines in PF_5, IF_5, and BrF_5 indicates nonequivalent electronic distributions in the structurally distinguishable bonds. The measurements were facilitated by a large permanent magnet, the design and field homogenization of which are described.

7038
APPLICATION OF LEMMAS OF SIMILARITY TO CALCULATION OF VIBRATION SPECTRA OF ISOTOPIC MOLECULES. V. M. Tatevskiĭ. Zhur. Fiz. Khim. 25, No. 3, 274-82(1951) Mar. (In Russian)

The theory is developed and used to calculate fundamental frequencies of D_2O, T_2O, D_2S, T_2S, D_2Se, T_2Se, ND_3, NT_3, PD_3, PT_3, AsD_3, AsT_3, CD_4, CT_4, SiT_4, GeD_4, GeT_4, etc. The results are compared with the experimental values for the corresponding H compound and with other available experimental data.

7039
A NUCLEAR MAGNETIC PARAMETER RELATED TO ELECTRON DISTRIBUTION IN MOLECULES. H. S. Gutowsky, D. W. McCall, B. R. McGarvey, and L. H. Meyer. J. Chem. Phys. 19, 1328-9(1951) Oct.

A preliminary report is presented of the determination of electron distribution in substituted benzenes by measuring the effect of the substituent group on the F^{19} magnetic shielding in the appropriate fluorobenzene. Results obtained from determinations of several o-, m-, or p-substituted fluorobenzenes are included.

RADIATION CHEMISTRY

7040
Carbide and Carbon Chemicals Co., K-25
IONIZATION OF FLUOROCARBON GASES BY U-234 ALPHA PARTICLES; by M. E. Steidlitz, F. D. Rosen, C. H. Shiflett, and W. Davis, Jr. Issued Sept. 5, 1951. 17p. (K-788)

The range of and total ionization by U^{234} α particles in A, N_2, F_2, $CHClF_2$, CF_4, $CClF_3$, CCl_2F_2, CCl_3F, CCl_4, C_2ClF_5, C_2Cl_3, C_4F_8O, and C_4F_{10} have been measured. The ranges have been correlated with atomic number functions by use of the equations of Bragg and of Geiger (Proc. Roy. Soc. (London) 83A, 505(1910)).

7041
EFFECT OF ORGANIC SUBSTANCES ON THE γ-RAY OXIDATION OF FERROUS SULFATE. H. A. Dewhurst. J. Chem. Phys. 19, 1329(1951) Oct.

A series of experiments is described in which a number of aliphatic alcohols were added to solutions of ferrous sulfate in 0.8N sulfuric acid, and the effect of these on the initial oxidation yield for ferrous ions studied. Samples were irradiated with the γ rays from a Co^{60} source. It was found that the aliphatic alcohols had a pronounced accelerating effect on the initial oxidation yield. In all cases the amount of oxidation was found to be a linear function of the energy absorbed, at least in the initial stages of the reaction. Results are presented in tabular form and correlated with previously published studies.

RADIATION EFFECTS

7042
Atomic Energy Project, Univ. of Calif., Los Angeles
THE IRRADIATION OF LINOLEIC ACID; A CHAIN REACTION; by James F. Mead. Issued Oct. 12, 1951. 18p. (UCLA-160)

The effect of x irradiation on dilute aqueous solutions of linoleic acid has been found to be the initiation of a chain reaction similar to that occurring during autoxidation. Very high ionic yields were obtained by increasing the concentration of linoleic acid above 5×10^{-3}M and by decreasing the intensity of x irradiation to 10r/min. The reaction is proposed as a possible model for the effect of small doses of radiation on animals. (auth)

SEPARATION PROCEDURES

7043
Oklahoma A. and M. Coll. Research Foundation
A STUDY OF THE LIQUID-LIQUID EXTRACTION AND SEPARATION OF SALTS; by Paul C. Yates and Tom E. Moore. Sept. 15, 1951. 31p. (AECU-1669)

Conclusions from a study of the liquid-liquid extraction of electrolytes and the application of this procedure to separation of metal ions are presented. Chloro-complex formation occurs in anhydrous systems containing $NiCl_2$, octanol, and LiCl in great excess. Present indications are that a $NiCl_3^-$ ion is formed. Cobalt chloride exists in the octanol phase largely as undissociated $CoCl_2$ (exclusive of possible solvation or dimerization). Both the $NiCl_3^-$ ion and higher chloro-complexes of Co seem to be unstable in the presence of H_2O. No 1 : 1 correlation exists between the extraction of promoting chlorides (HCl, LiCl, $CaCl_2$, $AlCl_3$ or $N(CH_3)_4Cl$) and the extraction of $CoCl_2$ into octanol. The extraction of the promoting chloride in the presence of $CoCl_2$ seems to be governed largely by thermodynamic factors in the aqueous phase. The largest single factor influencing the extent of the extraction of $CoCl_2$ seems to be magnitude of its activity coefficient in the aqueous phase.

7044
ION EXCHANGE. G. E. Boyd. Ann. Rev. Phys. Chem. 2, 309-42(1951).

This review deals with synthetic organic ion-exchange polymers and their applications. Specific subjects discussed include synthesis, chemical structure, and basic physical chemistry of ion-exchange polymers, ion-exchange equilibria, ion-exchange kinetics, ion-exchange chromatography, and separations accomplished by ion exchange. 194 references.

7045
RECOIL EFFECTS IN FINELY PULVERIZED SUBSTANCES IRRADIATED WITH NEUTRONS. Pierre Jordan. J. chim. phys. 48, 179-81(1951) Mar.-Apr. (In French)

If moistened powders are irradiated with neutrons, the recoil of newly formed atoms may drive them into the liquid layer surrounding the solid grains; filtering will complete the isolation of the irradiation product in the form of a solution. Experiments with water-moistened powders of ZnO, MnO_2, $Fe(OH)_3$, SiC, MgO, and SiO_2 illustrate various aspects of the procedure, such as the role of adsorption and recrystallization effects, and the size of powder grains. The method can be used for the separation of products of reactions (n,p) and (n,α) from those of reactions (n,γ) and (n,2n), based on the fact that the products of the latter reactions, which are isotopes of the irradiated element, will not be found in the liquid phase because of exchanges with the solid phase.

7046
CALCULATION OF THE EQUILIBRIUM IN ISOTOPIC EXCHANGE REACTIONS. V. M. Tatevskiĭ, Zhur. Fiz. Khim. 25, No. 3, 261-73(1951) Mar. (In Russian).

An extensive development of the mathematical expressions for the equilibrium in reactions of the type $n_1A + n_2B' \ldots \rightleftharpoons n_1B + n_2A' \ldots$, where A and A′, B and B′, etc., are isotopic molecules, is presented. All possible reaction intermediates are taken into account. Various functions involved in practical calculations are tabulated. The equilibrium constants of the following reactions are calculated as examples: $H_2O + D_2S$ at 1000°K; $CH_4 + CD_4$, CHD_3, CH_2D_2, and CH_3D at 1000 and 2000°K; and $CCl_4^{35} + CCl_4^{37}$, $CCl_3^{37}Cl^{35}$, $CCl_2^{37}Cl_2^{35}$ and $CCl^{37}Cl_3^{35}$ at 100 to 150°C.

SYNTHESES

7047
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
NUCLEAR CHEMISTRY (ORGANIC) GROUP, p.30-3 of PROGRESS REPORT; JANUARY 1, 1951. 4p. (NP-3437 (p.30-3))

Norbornyl-2,3-C_1^{14} p-bromobenzenesulfonate has been found by means of infrared analysis and solvolysis-rate

studies to be a mixture of 57% of the exo- and 43% of the endo-isomers. Treatment of cyclopropylcarbinol-α-C^{14} with $ZnCl_2$-HCl yielded allylcarbinyl chloride in which the activity was distributed equally among carbons 1, 3, and 4, which were the methylene carbon atoms in the original cyclopropylcarbinol. The reaction and degradation procedures are outlined. In continuation of the study of s-butyl carbonium ions, it has been found that hydrolysis of 2-butyl-1-C^{14} p-toluenesulfonate in 75% aqueous acetone yields essentially unrearranged 2-butanol. Chemical formulas describing the preparation of 2-methylbutane-1-C^{14} are shown.

7048

Radiation Lab., Univ. of Calif.

THE PREPARATION OF CODEINE- AND MORPHINE-N-METHYL-C^{14}; by Henry Rapoport, Calvin H. Lovell, and Bert M. Tolbert. Sept. 28, 1951. 4p. (UCRL-1455)

Codeine-N-methyl-C^{14} was prepared by removing the N-methyl group from acetyl-codeine to obtain N-cyanoacetylnorcodeine, hydrolyzing this intermediate to norcodeine, and then remethylating with methyl iodide (methyl-C^{14} iodide) to form codeine. Pyridine hydrochloride was used to effect the cleavage of codeine-N-methyl-C^{14} to morphine-N-methyl-C^{14}.

7049

THE SYNTHESIS OF ACETYL-1-C^{14}-SALICYLIC ACID. Jean W. Clappison, J. P. Hummel, and J. I. Routh. J. Am. Pharm. Assoc., Ed. 40, 532(1951) Oct.

Acetyl-1-C^{14}-salicylic acid was prepared from sodium acetate-1-C^{14} by formation of acetyl-1-C^{14}-chloride which reacted with salicylic acid in the presence of dimethyl aniline. (auth)

7050

SYNTHESIS OF RADIOACTIVE DIETHYL-p-NITROPHENYL-MONOTHIOPHOSPHATE, AND EXAMPLES OF ITS BIOLOGICAL APPLICATIONS. Siegfried Lockau, Manfred Lüdicke, and Friedrich Weygand. Naturwissenschaften 38, No. 15, 350(1950) Aug. (In German)

P^{32}-labeled diethyl-p-nitrophenyl-monothiophosphate, $(C_2H_5O)_2PSOC_6H_4NO_2$, was prepared by the following steps: $2P^{32} + 5Cl_2 = 2P^{32}Cl_5$; $3P^{32}Cl_5 + P_2S_5 = 5P^{32}SCl_3$ (32% yield, purified by distillation); $P^{32}SCl_3$ + p-nitrophenolsodium (with cooling, then on water bath) = p-nitrophenyldichlorothiophosphate (p-nitrophenoxydichlorophosphine sulfide); metathesis with Na acetate yields the product. Some results of studies of the use of this compound as a contact insecticide are reported.

7051

THE DOMINANT ROLE OF THE LIVER IN PLASMA PROTEIN SYNTHESIS. L. L. Miller, C. G. Bly, M. L. Watson, and W. F. Bale. J. Exptl. Med. 94, 431-53(1951) Nov.

A direct study of the isolated rat liver perfused with oxygenated blood containing amino acids and lysine-ϵ-C^{14} has yielded facts indicating that the liver synthesizes practically all the plasma fibrinogen, the albumin fraction, and probably more than 80% of the plasma globulin fraction. The response of the isolated perfused liver in protein synthesis is qualitatively and quantitatively analogous to that of the intact animal, notably in the ability to discriminate between natural L-lysine and D-lysine, the per cent of isotopic amino acid converted to CO_2, and the per cent utilized in liver and plasma protein synthesis. The results obtained with the perfused liver are compared and contrasted with those reported for tissue homogenates, minces, and slices.

TRACER APPLICATIONS

7052

Ames Lab.

THE SOLUBILITY OF SILVER CHLORIDE AND THE FORMATION OF COMPLEXES IN CHLORIDE SOLUTION; by J. Haworth Jonte and Don S. Martin, Jr. Oct. 20, 1951. 12p. (ISC-166)

A radioassay technique has been used to determine the concentration of Ag in various chloride solutions in contact with AgCl at temperatures of 15.0, 25.0, and 35.0°. A minimum in Ag concentration of about 5×10^{-7} M was found at 25° for a chloride activity of 2×10^{-3}. The data have been interpreted in terms of equilibria which involve the species Ag^+, AgCl(aq), $AgCl_2^-$ and AgCl(s). Equilibrium constants and thermodynamic quantities for the reactions involving these species have been calculated. (auth)

7053

RADIOACTIVITY APPLIED TO CHEMISTRY. A. C. Wald and N. A. Bonner, editors. New York, John Wiley & Sons, Inc., 1951. 604p.

An abstract of this book appears in Anal. Chem. 23, 1523-4(1951) Oct. and is reproduced here in part.

This book presents a comprehensive summary of the fundamental contributions to physical chemistry that were performed with the aid of radioactive tracers. Topics such as isotopic exchange, kinetics, and structural chemistry cut across the traditional lines of organic and inorganic chemistry. Specialized topics, such as the chemistry of the newer elements and chemical effects of radiation, are also included. A large fraction of the book is devoted to studies of separation methods and to the extension of classical quantitative techniques.

URANIUM AND URANIUM COMPOUNDS

7054

Imperial Chemical Industries, Ltd., Widnes (England)

THE PREPARATION OF URANIUM HEXAFLUORIDE FROM ENRICHED URANIUM SALT; by I. L. Bradley. Jan. 22, 1946. 2p. (BR-683A)

7055

Carbide and Carbon Chemicals Co., K-25

CORRELATION OF CRITICAL TEMPERATURE WITH THERMAL EXPANSION OF LIQUID URANIUM HEXAFLUORIDE; by G. P. Rutledge. July 15, 1949. Decl. Oct. 29, 1951. 7p. (AECD-3264; K-445)

The critical temperature of UF_6 has been predicted from an equation relating the critical temperature to the thermal expansion coefficient, which was derived by the author in a previous paper (K-419), and from density determinations of liquid UF_6 at various temperatures made by the National Bureau of Standards. The value obtained was 218.5°C.

7056

Carbide and Carbon Chemicals Co., K-25

URANIUM AND ITS COMPOUNDS; A BIBLIOGRAPHY OF UNCLASSIFIED LITERATURE; by Fred E. Croxton. Issued Mar. 1, 1951. 708p. (K-295(Pt.2))

Most of the 3970 references in this bibliography on chemistry, physics, biology, and physical metallurgy of U and its compounds are accompanied by abstracts or annotations. References cover the period 1789 to 1950 and include reports issued by the Atomic Energy Commission as well as published papers. Author, subject, and numerical indexes are included.

7057

Carbide and Carbon Chemicals Co., K-25

WERNER-TYPE URANIUM COMPLEXES; by John T. Barr and Charles A. Horton. Issued May 7, 1951. Decl. Oct. 26, 1951. 36p. (AECD-3263; K-705)

A study has been made of the action of organic bases, acidic complexing agents, and amino acids upon organic solutions of $UO_2(NO_3)_2.6H_2O$ and UCl_4. The type of product obtained was a function of both the oxidation state of the U and of the type of complexing agent. Acidic complexing

agents did not form isolable products with either UO_2^{++} or U(IV) salts, although spectrophotometric evidence indicated that enolized 1,3-diketones complexed to some extent. The addition of an external base to solutions of a U compound and complexing agent precipitated Werner-type complexes. Complexing agents which themselves contained an amino group reacted readily with uranyl salts to form inner complexes, and with U(IV) salts to form Werner-type complexes. It is proposed that the mechanism of the reaction depends upon preliminary attack upon the U atom by a basic group, followed by step-by-step substitution of the inorganic anion by complexing groups until the maximum coordination number of the U atom is attained. Interpretation of the infrared spectra of 10 of the complexes and ammines confirms the formation of a strong U-to-N coordinate-covalent bond, and shows that, in the complexes, the coordinating groups were bound directly to the central U atom. Preliminary assignments are made for absorption bands due to the RCOO-U linkage.

7058
THE TETRAVALENCE OF URANIUM AND PLUTONIUM IN THE URANYL AND PLUTONYL RADICALS. G. E. Villar. Bol. facultad ing. Montevideo 4, No. 1, 1-11(1950) May. (In Spanish)

The marked similarity among the actinides, especially U and Pu, is pointed out. Reasons are given for believing that U acts as a tetravalent element in its oxides, uranates, and uranyl salts instead of as a hexavalent element as has been generally assumed, and that Pu exhibits a similar tetravalence. It is suggested that the two O atoms of any peroxide molecule are bound by a coordinate covalent bond in such a way that the valences of one of the O atoms are saturated while the other O has two free valences which can be saturated with two atoms of a monovalent metal. The peroxides of U and Pu would have a similar structure, both elements acting as tetravalent. In place of the generally accepted structure of the uranyl radical, a structure is proposed consisting of a ring with the three constituent atoms bound much more intimately. The O atoms are bound to each other by a covalent bond, while they are bound by a single polar bond to the U atom. Experiments by other investigators are cited to substantiate this point of view. The hydrolysis of uranyl nitrate is indicated by a structural equation. In the oxidation of both PuF_3 and PuF_4 the product of the oxidation corresponds to a compound of tetravalent Pu. Structures corresponding to this hypothesis are suggested for ionic species in uranyl solutions.

7059
FINE STRUCTURE OF THE X-RAY ABSORPTION SPECTRA OF CERTAIN ELEMENTS. I. B. Borovskiĭ and R. L. Barinskiĭ. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 15, No. 2, 225-30(1951) Mar.-Apr. (In Russian)

Experimental absorption coefficients measured near the L_{III}, M_{III}, and M_V absorption edges of UO_3 and UO_2 are plotted, and the observed fine structure is related to electronic configurations.

ENGINEERING

7060
Hanford Works
HOT LABORATORY EQUIPMENT CATALOG (For Use of Chemists, Physicists, Metallurgists, Designers, etc.); John F. Gifford, comp. Aug. 1, 1951. 68p (HW-22597)

This catalog was prepared originally for use in the Hanford Works, and is intended as a ready source of ideas on equipment and handling methods, for information only. It is arranged for quick scanning by chemists, physicists, metallurgists, or designers, with reference to additional information such as blueprints, originator, etc.

7061
Stanford Research Inst.
INDUSTRIAL USES OF RADIOACTIVE FISSION PRODUCTS; Weldon B. Gibson and Ralph A. Krause. [nd] 106p. (AECU-1673)

The conclusions presented in the report answer the four objectives of this investigation, namely, (1) do radioactive fission products have potential large-scale uses, (2) what is the estimated size of any potential industrial market for fission products, (3) what major problems confront AEC in connection with large-scale use of fission products, and (4) what research and development programs should be undertaken to encourage industrial use of large quantities of fission products?

7062
General Electric Research Lab.
A MAGNETICALLY DRIVEN MANIPULATOR FOR MOVING AND ACCURATELY POSITIONING EQUIPMENT IN A VACUUM CHAMBER; by J. Fielding and F. J. Studer. Dec. 1950. 7p. (RL-481)

7063
NEUTRON LOGGING OF DRILL HOLES: THE NEUTRON-NEUTRON METHOD. C. W. Tittle, Henry Faul, and Clark Goodman. Geophysics 16, 626-58(1951) Oct.

Experiments were performed to determine the distribution of thermal neutrons and of indium resonance neutrons in continuous hydrogenous media and in pipes passing through hydrogenous media. Included in the study were water, brine, mixtures of sand and water, and mixtures of sand and brine. Experiments in a continuous typical barite drilling mud showed that the neutron distributions were essentially the same as in water. Also, from the point of view of these experiments, oil and fresh water are nearly identical. These experiments show that well fluid (and, by inference, cement) imposes serious limitations on the sensitivity and accuracy of the neutron-neutron logging method (neutron source–neutron detector). The indium resonance neutron response (or, in general, the intensity of epithermal neutrons) is a more reliable indicator of hydrogen content of the formation than is the thermal neutron response. The neutron-neutron method of chlorine determination was found to be not sensitive enough to be useful with brines of the concentrations ordinarily found in reservoirs. (auth)

7064
INDUSTRIAL APPLICATIONS OF RADIOACTIVITY. George G. Manov. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.91-7.

A brief survey is made of the more important uses of radioisotopes in industry. These include radiography, gages, detection of transfer of materials, and study of chemical reactions.

7065

POTASH CONTENT BY GEIGER COUNTER. Hans Friedmann. Eng. Mining J. 152, 90-1, 119(1951) Oct.

Methods previously described for determining K by its natural radioactivity by use of a G-M counter have been successfully applied in a cement plant. A method is described which speeds up the many K determinations required. Analysis of fine dust containing 80 to 90% K_2SO_4 can be made by this method in 1 to 3 hr, as compared with 1 to 2 working days previously required.

HEAT TRANSFER AND FLUID FLOW

7066

Metallurgical Lab., Univ. of Chicago

TEMPERATURE RISE IN A HEAT PRODUCING CYLINDER UNDER A COATING DEFECT; by M. Ginsburg, W. Karush, and G. Young. Jan 25, 1944. Decl. Oct. 18, 1951. 19p. (AECD-3258; CP-1317(A-1870)Rev.)

A jacketed heat-producing externally cooled cylinder will be subject to local temperature rises if there is defective thermal contact between the coating and the interior cylinder. The problem of finding the perturbed temperature field that arises when an insulating or partially conducting piece of surface (the defect) is introduced normal to the original lines flow is considered. A simple, fairly accurate formula is established for defects in the form of round spots or long strips parallel to the axis of the cylinder. The following assumptions are made: the conductance is constant over the defect, the heat production distribution in the cylinder is not altered, the cylinder is treated as a semi-infinite solid, its curvature being ignored, and temperature is constant across the coating normal to the surface. The temperature rise at the edge of the defect is discussed briefly.

7067

Metallurgical Lab., Univ. of Chicago

VALUES FOR THE EDDY DIFFUSION COEFFICIENT; by W. Karush. June 8, 1945. Decl. Oct. 19, 1951. 10p. (AECD-3256; CP-3041)

The problem of diffusion in a turbulent stream flowing between parallel plates is considered. The experimentally determined mass-diffusion coefficient D is compared with the hypothetical coefficients of diffusion of momentum of mean motion D_m and of vorticity D_v. Velocity measurements showed that D_m (in the turbulent core) was substantially independent of distance from the wall, a condition which implies $D_v = D_m$. However, a literature survey showed that, in the case of the diffusion of heat in the wake of a heated cylinder, measurements of velocity and temperature give $D = D_v = 2D_m$. 8 references.

7068

California Univ., Berkeley

HEAT TRANSFER TO A FLUID FLOWING TURBULENTLY IN A SMOOTH PIPE WITH WALLS AT CONSTANT TEMPERATURE; by R. A. Seban and T. Shimazaki. Sept. 10, 1949. 23p. (NP-3400)

7069

Division of Industrial Cooperation, Mass. Inst. of Tech.

A METHOD OF CORRELATING HEAT TRANSFER DATA FOR SURFACE BOILING OF LIQUIDS (Technical Report No. 5); by Warren M. Rohsenow. July 1, 1951. 27p. (NP-3443)

A method based on a logical explanation of the mechanism of heat transfer associated with the boiling process is presented for correlating heat-transfer data for nucleate boiling of liquids for the case of pool boiling. A bubble Reynolds number $N_{Re,b}$ is defined, as a measure of the local agitation of the fluid at the heating surface. A bubble Nusselt number $N_{Nu,b}$ and the Prandtl number are also used. The correlation suggested is $N_{Nu,b} = \phi(N_{Re,b}, N_{Pr})$, where the various fluid properties are evaluated at the saturation temperature corresponding to the local pressure. The proposed correlation equation is applied to the data of various experimenters. The final correlation results in an explicit equation, one form of which is $N_{Nu,b} = \frac{1}{C_{sf}} N_{Re,b}^{0.667} N_{Pr}^{-0.7}$, where C_{sf} is a function of the particular heating surface-fluid combination. 10 figures.

7070

Massachusetts Inst. of Tech.

HEAT TRANSFER AND PRESSURE DROP DATA FOR HIGH HEAT FLUX DENSITIES TO WATER AT HIGH SUBCRITICAL PRESSURES (Technical Report No. 3); by Warren M. Rohsenow and John A. Clark. Apr. 1, 1951. 47p. (NP-3385)

Results for local surface coefficients of heat transfer, over-all pressure-drop data, and mean friction factor are tabulated and graphed for heat fluxes up to 3.5×10^6 Btu/hr/ft² for water flowing in a nickel tube under the following conditions: mass rates of flow up to 5.6×10^6 lb/hr/ft² (or inlet velocities up to 30 ft/sec), absolute pressures up to 2000 psia, and liquid subcooling between 50 and 250°F.

7071

ON THE EFFECT OF CROSS SECTION PROFILE OF THE BOILING TUBES ON STEAM GENERATION IN LOW PRESSURE CIRCULATING SYSTEMS. G. M. Levin. Zhur. Tekh. Fiz. 21, No. 5, 552-63(1951) May. (In Russian)

The boiling process in annular tubes is contrasted with that in circular tubes. 5 figures.

7072

CERTAIN HETEROGENEOUS BOUNDARY PROBLEMS OF THE HEAT TRANSFER EQUATION. M. M. Smirnov. Priklad. Mat. i Mekhan. 15, No. 3, 367-70(1951) May-June. (In Russian)

The heat transfer equation, $\partial u/\partial t = \partial^2 u/\partial \times^2$, is solved for various boundary conditions.

7073

SOME EXACT SOLUTIONS OF TEMPERATURE DISTRIBUTION IN A LAMINAR FLOW. H. Schlichting. Z. angew. Math. u. Mech. 31, 3, 78-83(1951) Mar. (In German)

An abstract appears in Applied Mechanics Revs. 4, 576 (1951) Oct. and is reproduced here in its entirety.

Exact solutions are given for the temperature distribution in incompressible flow for the Couette flow, Poiseuille pipe flow, and the flow between two concentric rotating cylinders. Frictional heat is included but the dependence on temperature of the coefficients of viscosity and thermal conductivity is neglected. (auth)

7074

RADIATION HEAT EXCHANGE IN AN ABSORBING MEDIUM. S. N. Shorin. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 3, 389-406(1951) Mar. (In Russian)

An abstract appears in Applied Mechanics Revs. 4, 576-7 (1951) Oct. and is reproduced here in its entirety.

First section gives basic theory. Second section describes heat transfer in a plane-parallel layer which is moving against an absorbing medium. Two cases considered are given temperature distribution and given heat output. Results are applied in third section to discussion of heat transfer in boiler furnaces and compared with results of A. M. Hurwitz and V. I. Timofeyev.

7075

THERMODYNAMICS OF FLUID FLOW. N. A. Hall. New York, Prentice-Hall, Inc., 1951. 278p.

An abstract appears in Applied Mechanics Revs. 4, 575 (1951) Oct. and is reproduced here in part.

This engineering text deals with one-dimensional steady flow of enclosed fluids. Main emphasis is on theory and especially that theory pertaining to perfect gases. The

context by chapter headings: 1. Introduction; 2. Fluid friction; 3. Energy and continuity; 4. Momentum principles; 5. Incompressible fluids; 6. Perfect gases; 7. Constant-area adiabatic flow; 8. Varying-area adiabatic flow; 9. Shock regions; 10. Flow measurement and control; 11. Diabatic flow; 12. Propulsion systems. The appendix contains tables of derived flow functions.

7076
ON THE DIFFERENTIAL EQUATIONS OF GAS MOTION. N. A. Slezkin. Doklady Akad. Nauk S.S.S.R. 77, 2, 205-08(1951) Mar. (In Russian)

An abstract appears in Applied Mechanics Revs. 4, 567 (1951) Oct. and is reproduced here in part.

The equations of continuity, motion, and energy are written in orthogonal curvilinear coordinates differing from the usual form by the addition of terms representing diffusion and thermodiffusion.

7077
CRITICAL REGIMES OF FLOWS WITH DENSITY STRATIFICATION. A. Craya. Tellus 3, 1, 28-42(1951) Feb.

An abstract appears in Applied Mechanics Revs. 4, 566 (1951) Oct. and is reproduced here in part.

The author discusses critical-flow criteria for both internal and surface gravity currents and shows analogy to the case of simple open-channel flow. Discussion concerns, first, open-channel flow, then homogeneous gravity currents and, finally, currents with density stratification. In the latter case the calculus of variations is used for minimizing. For currents with density gradients, a significant difference is shown in the critical-flow criteria, depending on whether the energy or momentum theory is used. For surface currents, if the vertical displacements are restricted, maximum velocity will occur at some distance down from the surface. Thorough discussion covers both theory and results.

7078
QUANTUM CORRECTIONS TO TRANSPORT PROPERTIES AT HIGH TEMPERATURES. J. DeBoer and R. Byron Bird. Phys. Rev. 83, 1259-60(1951) Sept. 15.

In the quantum theory of transport phenomena the standard formulas in Boltzmann statistics for the cross section for diffusion, thermal diffusion, and viscosity of mixtures and for the cross section for viscosity and thermal conductivity are given. It is then shown how the cross sections can be expressed as power series in Planck's constant for the temperature region in which the deviations from classical behavior are small. The first term of the series, not containing $\hbar$, is the well-known classical expression for each of the transport properties. The series converges only in the temperature region where the deviations from classical theory are relatively small.

7079
FLUID MECHANICS. V. L. Streeter. New York, McGraw-Hill Book Co., Inc., 1951. 366p.

A review of this book appears in Applied Mechanics Revs. 4, 565(1951) Oct. and is reproduced here in part.

The first two chapters deal with fluid statics, followed by a chapter introducing the concepts, basic difinitions, and equations of fluid motion. Another chapter is devoted to basic principles of turbomachinery with application to pumps, blowers, turbines, fluid coupling, and torque converters, with a brief discussion of the basic principles of jet propulsion. Considerable attention is given to flow in tubes, conduits, and channels. Flow around immersed bodies is discussed in a separate chapter covering simplified treatments of equations of motion, velocity potential, stream function, boundary layer, and drag. A final chapter deals with oil hydraulic systems.

7080
FLOW OF COMPRESSIBLE FLUIDS. R. Sauer. Paris and Liége, Libr. Polytechn. Ch. Beranger, 1951. 307p. (In French)

A review of the book appears in Applied Mechanics Revs. 4, 567(1951) Oct. and is reporduced here in part.

The first chapter discusses the fundamental mechanical and thermodynamical concepts and presents the basic equations of compressible fluid flow. In addition, unidimensional flows in tubes are discussed in detail. Stationary and nonstationary flows with either constant or variable entropy are included. Linearized theory is treated next, including applications to the propagation of pressure waves. The third chapter deals with more rigorous theories for steady supersonic flow and for pressure waves of large intensity. The fourth chapter describes the foundation and methods of the theory of characteristics from the point of view of one interested in practical applications, and cites applications to two-dimensional and axisymmetric steady supersonic flows and to nonsteady flows in tubes. Chapter five, on exact theory of stationary subsonic flow, contains considerable discussion of transonic flows as well. The remaining two chapters are concerned with shock phenomena.

7081
INTRODUCTION TO HEAT TRANSFER, 2nd ed. A. I. Brown and S. M. Marco. New York, McGraw-Hill Book Co., Inc., 1951. 267p.

A review of the book appears in Applied Mechanics Revs. 4, 576(1951) Oct. and is reproduced here in part.

Steady-state conduction equations are developed from the basis Fourier equation and applied to heat flow through plane composite walls and to flow through composite pipe walls. A method of determining heat flow by mapping curvilinear squares is illustrated. The chapter on radiation introduces the necessary fundamental concepts and indicates the method of deriving such relations as the Stefan-Boltzmann law and shape factors. Three chapters are devoted to the study of heat transfer by convection. Short chapters on heat transfer to boiling liquids and condensing vapors round out the basic material on steady-state heat transfer. The over-all transfer of heat is summed up in a chapter, and the more commonly used mean temperature differences, such as the logarithmic, are presented. The concluding chapter is headed "Variable Heat Flow." Fourier's general law of heat conduction is stated but no solutions of the equation are derived. The problem is attacked by the method of dimensional analysis and correlated to the solutions of Fourier's equation for most of the standard unsteady heat-conduction problems.

MATERIALS TESTING

7082
Illinois Univ., Engineering Experiment Station
FATIGUE TESTING AND TEST INTERPRETATION; TECHNICAL REPORT NO. 26 ON THE BEHAVIOR OF MATERIALS UNDER REPEATED STRESS; by A. M. Freudenthal. July 1951. 53p. (NP-3447)

Various material factors and testing conditions which contribute to the scatter found in fatigue data are reviewed in a general manner. The inadequacies of conventional procedures for planning and interpreting fatigue tests are discussed and various applications of statistical theory are considered. An attempt is made to derive the cumulative frequency distribution function of fatigue life, at any particular stress amplitude, from considerations of statistical theory. The theoretically derived distribution is shown to approximate the results of rotating-beam and reversed-torsion fatigue tests on steel, Al, and Cu. A possible means

is suggested for estimating the endurance limit of some metals through analysis of statistical data. (auth)

7083

California Inst. of Tech.

A STUDY OF THE MECHANISM OF THE DELAYED YIELD PHENOMENON; by T. Vreeland, Jr., D. S. Wood, and D. S. Clark. Sept. 1951. 39p. (NP-3433)

The behavior of an annealed low-carbon steel subjected to a rapidly applied constant stress and to repeated short-duration stress-pulses was investigated. The test stresses were greater than the upper yield stress. Plastic and anelastic microstrain of the order of 30×10^{-6} in./in. was observed prior to the onset of yielding in both tests. Aging of the specimens for a sufficient length of time at a given temperature between stress-pulses induced recovery in the material such that yielding did not occur in repeated stress-pulse and aging cycles. The activation energy of the recovery process corresponds, within the limits of the experimental accuracy, to the activation energies of C and N diffusion in Fe. These effects are discussed in terms of the dislocation theory of yielding. The delayed yield and the microstrain is attributed to the action of dislocations within the crystals of the material. The recovery process is attributed to the diffusion of C and N to the dislocations which have been displaced, thus stabilizing the array of dislocations for the particular stress condition. (auth)

7084

CREEP OF METALS. L. A. Rotherham. London, Institute of Physics, 1951. 80p.

An abstract appears in Applied Mechanics Revs. 4, 558 (1951) Oct. and is reproduced here in part.

The first chapter discusses fundamental characteristics of the technical creep curve including effects of stress, temperature, creep recovery, and grain size. The next two chapters discuss slip process, crystalline flow, and metallographic features of creep. Additional sections deal with grain-boundary creep, transient creep (including various theories), steady-state creep including chemical rate and dislocation theories, and tertiary creep. A short section on so-called stress-rupture tests is also included. The final chapter treats development of creep-resistant alloys. No discussion is given of creep under biaxial or triaxial stress, nor is the subject of relaxation covered.

7085

EFFECT OF AMPLITUDE OF DYNAMIC STRESS ON HIGH TEMPERATURE FATIGUE LIFE. John E. Breen. A.S.T.M. Bull. No. 177, 38-9(1951) Oct.

A dynamic stress superimposed on a test specimen of single-phase material during a stress-rupture test at elevated temperature generally caused a decrease in the rupture life of the specimen. At low dynamic stresses, the decrease in rupture life was slight, and in some cases it was even increased. But, in general, the greater the dynamic stress the greater was the decrease in rupture life.

RADIOGRAPHY

7086

AUTORADIOGRAPHIC TECHNIQUE WITH CARBON 14 IN RUBBER. A. D. Kirshenbaum, C. W. Hoffman, and A. V. Grosse. Anal. Chem. 23, 1440-5(1951) Oct.

Carbon black was made radioactive by reacting at elevated temperatures with $C^{14}O_2$. Good and bad carbon black-rubber mixes were prepared. Autoradiographs of these mixes showed visible variations in the carbon distribution which agreed closely with tensile-strength data. The technique was also used to track down the agglomeration of carbon black in the rubber.

TRACER APPLICATIONS

7087

DEUTERON ACTIVATION AND AUTORADIOGRAPHY AS COUPLED TECHNIQUES IN TRACER EXPERIMENTS. K. M. Laing, R. E. Jones, D. E. Emhiser, J. V. Fitzgerald, and G. S. Bachman. Nucleonics 9, 44-6(1951) Oct.

In the glass industry the oxides in melted glass attack and dissolve the oxides in the refractory containers. Sodium, employed to facilitate the melting of the other ingredients, also aids in the attack. By deuteron activation after the reaction in a sample had taken place, the distribution of sodium, which had by far the largest deuteron cross section, could be studied in the refractory by radiography.

VACUUM SYSTEMS

7088

MOLECULAR STREAMING THROUGH COMPOSITE TUBING. Wolfgang Harries. Z. angew. Physik 3, 296-300 (1951) Aug.

Equations are given for the computation of flow resistance in high-vacuum circuits. Resistance in the different components of the circuit has to be added. Equations are given for computation of long or short pieces of tubing, openings, narrowing portions, etc.

7089

TECHNIQUES AND EQUIPMENT FOR MEASUREMENT OF VERY SMALL GAS PRESSURE. I. VACUUM GAGES WITHOUT AMPLIFIER AND METHODS OF MEASUREMENT FOR VACUUM GAGES WITH AMPLIFIER. Helmut Schwarz. Arch. tech. Messen 188, T96-7(1951) Sept. (In German)

Brief descriptions of the different types of vacuum gages include on one hand those without amplifier, namely, mechanical or feather elastic and U-tube manometer, and those needing amplifiers, namely, compression, heat-conducting, friction, radiometric, and ionization vacuum gages.

7090

A SIMPLE METHOD OF LEAK DETECTION IN HIGH VACUUM APPARATUS. Ehrhard Volcker. Z. Naturforsch. 6a, 512-13(1951) Sept. (Note; in German)

A 10^{-3}M to 10^{-4}M alcoholic solution of fluorescein or eosin is painted on the suspected areas of the vacuum apparatus, which is then evacuated to at least several mm Hg. After 2 or 3 min the excess fluorescent solution is removed, and the glass is irradiated with ultraviolet light. All holes and surface defects are thus located. A high-frequency electrode may then be used to distinguish leaks from other defects.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

7091

DIELECTRIC PROPERTIES OF TITANIUM DIOXIDE FROM VARIOUS SOURCES. I. N. Belyaev, N. S. Novosil'tzev, A. L. Khodakov, and M. S. Shul'man. Zhur. Tekh. Fiz. 21, No. 5, 547-51(1951) May. (In Russian)

Dielectric properties of TiO_2 samples prepared by various methods and of various purities are plotted up to 10^8 cps, at room temperature. Dependence of the properties on temperature is shown in graphs from 25 to 150°C at 1.5×10^6 and 1.5×10^7 cps and from −170 to +160°C at 50 cps. 4 figures.

7092

A STUDY OF SOLID-STATE REACTION IN THE TERNARY SYSTEM $MgO-ZrO_2-SiO_2$. Wilfrid R. Foster. J. Am. Ceram. Soc. 34, 302-5(1951) Oct.

A study has been made of solid-state reaction at 1450°C in the ternary system $MgO-ZrO_2-SiO_2$. About 40 selected mixtures were studied. The crystalline phases developed during calcination were identified from x-ray patterns obtained with a Norelco spectrometer employing copper-target radiation. Proof was obtained of the ability to attain essentially complete reaction in the solid state in the ternary system $MgO-ZrO_2-SiO_2$ at temperatures in the vicinity of 1450°C. No ternary compounds were encountered. The system was found to consist of four subsystems or compatibility triangles. Results are compared with those of other investigators.

7093

RIGIDITY MODULUS OF SOME PURE OXIDE BODIES. Eugene Ryshkewitch. J. Am. Ceram. Soc. 34, 322-6(1951) Oct.

The rigidity modulus of several sintered pure oxides was measured using specially prepared test pieces. Specimens in the form of a cylindrical rod of circular cross section were made with an abruptly thickened end. This ensured a sufficient rigidity of the fastened end and provided a definite length of the sample that could be measured accurately. Sintered alumina was tested up to 1550°C. Monocrystalline corundum, sintered stabilized zirconia, sintered pure beryllia, thoria, spinel, and zircon were tested at room temperature. Close agreement was noted between rigidity-modulus values and Young's-modulus values.

7094

STUDY OF PARTICLE SIZE OF THE OPACIFYING PHASE IN TITANIA ENAMELS: 1, CHANGE OF PARTICLE SIZE WITH CHANGE OF CONCENTRATION OF DISSOLVED TiO_2. M. D. Beals, L. R. Blair, R. W. Foraker, and W. R. Lasko. J. Am. Ceram. Soc. 34, 291-7(1951) Oct.

Variation of particle size of titanium dioxide precipitated from titania-opacified enamels with its change in concentration was indicated by reflectance data and substantiated by electron micrographs of these precipitated crystals. The particle size of crystals in an anatase enamel can be controlled by adjusting the relative amount of TiO_2 incorporated in the enamel batch, large particles generally being produced at low TiO_2 concentrations and small particles at high TiO_2 concentrations. The particle size of crystals in the anatase enamels under study which produced the maximum reflectance fell in the range 0.17 to 0.22 μ. The particle-size distribution of the enamel becomes restricted as the concentration of the TiO_2 is increased. At very high concentrations most of the particles fall in the subpigmentary size ranges. Possible correlation of the data with the precipitation laws of von Weimarn is discussed. Two methods were used for obtaining particle-size data: the first was by the study of shadowed replicas of etched enamel disk surfaces, and the second and more important, by the study of TiO_2 crystals removed from an enamel by selective solution with hydrofluric acid.

7095

HIGH-TEMPERATURE BODIES DERIVED FROM MIXTURES OF MgO-TiN-NiO. L. D. Hower, Jr., J. W. Londeree, Jr., and H. F. G. Ueltz. J. Am. Ceram. Soc. 34, 309-13(1951) Oct.

Mixtures formulated from MgO-TiN-NiO were investigated in a search for a high-temperature refractory material. Components were selected on the basis of their physical and chemical properties. Sintering was performed in a protective argon atmosphere. NiO was reduced or dissociated to nickel metal during the sintering operation. Titanium nitride was introduced to promote a bond between the metallic phase, nickel metal, and the ceramic oxide, MgO. Data are presented for three compositions evaluated for transverse strength, resistance to oxidation expressed as per cent weight gain, and thermal shock in terms of transverse strength. Several compositions exhibited increased transverse strength after being exposed to an oxidizing atmosphere. (auth)

GEOLOGY AND MINERALOGY

7096

DETERMINATION OF THE GEOLOGICAL AGE OF TWO METEORITES BY THE ARGON METHOD. E. K. Gerling and T. G. Pavlova. Doklady Akad. Nauk S.S.S.R. 77, No. 1, 85-6(1951). (In Russian)

The ages of two meteorites were determined, by measuring the amount of A formed through the disintegration of K^{40}, to be 3.0×10^9 and 3.03×10^9 yr.

7097

Division of Raw Materials, AEC

GEOLOGY OF URANIUM DEPOSITS; A CONDENSED VERSION; by Donald L. Everhart. May 5, 1951. 34p. (RMO-732)

A condensation of current information on the nature and distribution of uranium ore deposits is presented. The general geologic features of some of the major types of deposits, together with examples, are discussed first; these are followed by brief comments concerning the radioactivity characteristics, suggested sampling procedures, and means of evaluating the deposits. A table presents current data on the common U minerals including composition, appearance, crystal type, etc. 20 references.

7098

Geological Survey

INVESTIGATIONS IN THE WOOD MINE, COLORADO; by Robert U. King. [nd] 3p. (TEM-102A)

Mining activities in the Wood mine on Quartz Hill, Gilpin County, Colo., and the geology in the vicinity of the mine are described. Occurrences of pitchblende and high radioactivity on the mine dump are reported.

METALS AND METALLURGY

7099

Massachusetts Inst. of Tech. Metallurgical Project

THE COEFFICIENTS OF THERMAL EXPANSION FOR ZIRCONIUM; by R. B. Russell. Oct. 19, 1951. 41p. (MIT-1073)

The expansion coefficients of anisotropic (hexagonal) Zr have been calculated from the lattice parameters of an alloy, containing 2.4 wt. % Hf, from 0 to 600°C. The lattice parameters were determined by Cohen's method from data obtained by x-ray diffraction of Zr sheet heated in vacuo. Expansion coefficients are expressed as true linear and volume coefficients, mean linear and volume coefficients, and resultant linear for different expansion directions in a single crystal. The true and mean coefficients are very nearly a straight-line function of the temperature, as would be expected from the relatively low characteristic temperature of Zr (280°K). Some results are reported for the effect of Hf on the lattice parameters of Zr. Grüneisen's constant has been evaluated by three different methods, using compressibility, heat capacity, and heat of sublimation values from the literature The true linear thermal expansion coefficients may be expressed within experimental error as follows:

$\alpha_c = 2.418 \times 10^{-6} + 0.01249 \times 10^{-6}T$ (|| to c axis) per °C,

$\alpha_a = 5.357 \times 10^{-6} + 0.00109 \times 10^{-6}T$ ($\perp$ to c axis) per °C,

where T is in °K.

7100

Ames Lab.

SOLID STATE PHYSICS AND SYNCHROTRON DEVELOPMENT, p. 20-34 of PROGRESS REPORT IN PHYSICS FOR THE PERIOD JANUARY 1, 1951, TO JUNE 30, 1951; by G. W. Fox, W. C. Caldwell, et al. Sept. 17, 1951. 15p. (ISC-175(p. 20-34))

An abstract of ISC-150, dealing with optical properties of counting diamonds, is included in the report. The electrical properties of sodium tungsten bronze have been shown to correspond to a metal which has the number of electrons in the conduction band equal to the number of sodium atoms in the crystal. The electrical resistivity and Hall coefficient was measured for one particular concentration, and the mobility and mean free path of the electrons calculated. The optical properties of these compounds suggest that the color of these crystals is caused by photoelectric absorption rather than by selective reflection. The thermal diffusivity and conductivity of Cu have been measured, and results are given. Similar measurements were made on Th, but no results are stated. The low-temperature group has measured the electrical resistivities of Ce, Pr, Nd, and La from 300 down to 2.2°K. Temperature hysteresis effects observed in Ce are interpreted in terms of a change in structure. La is also believed to undergo a change in structure, but Nd and Pr behave normally. The d-c resistances of copper-oxide and selenium rectifiers have been measured from 20 to −183°C.

7101

Dow Chemical Co.

DEVELOPMENT OF HIGH-TEMPERATURE MAGNESIUM ALLOYS WITH SPECIFIED NEUTRON CROSS SECTION; QUARTERLY STATUS REPORT; JUNE 1, 1950–SEPTEMBER 1, 1950. (Report No. 15035); by T. E. Leontis. Sept. 27, 1950. 32p. (NP-3146)

Complete properties of extruded Mg-Th alloys containing 0 to 50% Th are presented. Maximum creep resistance at 500° and 600°F is exhibited by alloys containing 3 to 6% Th, a composition range which has a considerably lower neutron capture cross section than the originally stipulated maximum value of 0.006/cm. Increasing the Th content to 14%, the amount limited by the neutron capture cross section value of 0.006/cm, enhances significantly the creep resistance at 400°F and the static properties at all temperatures. The maximum amount of Th in Mg consistent with good strength and ductility appears to be 20 to 25%. The addition of pure Ce to Mg-Th alloys, both cast and extruded, enhances the strength properties at temperatures up to 500°F but lowers the ductility markedly. The creep resistance of Mg-Th alloys at 500° and 600°F is definitely impaired by the addition of Ce whereas at 400°F some improvement is realized owing to the increase in the yield strength of the alloys. (auth)

7102

Sylvania Electric Products, Inc.

MEASUREMENT OF RELATIVE DIFFUSIVITIES DURING BINARY DIFFUSION; by R. W. Balluffi and B. H. Alexander. Issued Aug. 20, 1951. 22p. (SEP-74)

A method of measuring relative diffusion rates in binary systems has been developed which eliminates possible errors due to porosity effects caused by diffusion. A type of couple not developing porosity and containing inert markers on the original surfaces was used to measure relative diffusivities in α-brass single crystals. The diffusivity of Zn was 6.5 times that of Cu in single-crystal brass containing approximately 26 wt. % Zn.

7103

Ames Lab.

WELDING TANTALUM; by Adrian H. Daane. Oct. 20, 1951. 6p. (ISC-178)

To fabricate an article from 0.001- or 0.002-in. sheets of Ta, a sheet of the desired thickness is formed around an appropriate brass mandrel, and a folded "T" seam is made which extends about 1/16 in. out from the body of the mandrel. The mandrel is attached to a brass rod which passes through a Wilson seal in a brass head into the glass apparatus. The arc-welding electrode is also connected to a brass rod which passes through another Wilson seal in the apparatus. The weld is effected by passing the seam under the electrode by proper manipulation of the mandrel and electrode in the A- or He-filled glass apparatus at a pressure of 1 atm. The following currents from a 110-v d-c source were found necessary for the welds: for 0.003 in., 5 amp; 0.006 in., 8 amp; 0.009 in., 10 amp; 0.015 in., 14 amp. This method has been used with equal success with Mo.

7104

North American Aviation, Inc.

A STUDY OF THE ANNEALING KINETICS OF COLD-WORKED COPPER; by D. Bowen, R. R. Eggleston, and R. H. Kropschot. Issued Oct. 9, 1951. 19p. (NAA-SR-143)

The resoftening kinetics for cold work in Cu have been studied using residual resistance as a measure of the degree of recovery. The specimens were quickly heated to the annealing temperature, held at temperature for a measured time, and quenched for measurement. It was assumed that the cold work could be characterized by a number of lattice defects n, and that the residual-resistance change produced by these defects obeyed Matthiessen's rule. It was found that the resoftening could be represented by a single process of activation energy 28.3 kilocalories per mole. The complete annealing kinetics is well described by a fourth order reaction, $dn/dt = -\nu n^4 e^{-E/RT}$, where ν is the frequency factor corresponding to the order (4) of the reaction, E is the activation energy, R is the gas constant, and T is the absolute temperature. 7 figures. (auth)

7105

New Mexico Inst. of Mining and Tech., Socorro, N. Mex.

FINAL REPORT [ON INDIUM STUDIES]; by M. F. Stubbs. Sept. 1951. 6p. (NP-3436)

Investigation of the preparation, purification, oxidation, reduction, and polarographic analysis of In sulfides is described.

7106
Royal Aircraft Establishment, Farnborough, Hants (England)
THE YOUNG'S MODULUS OF SOLID SOLUTIONS OF COPPER AND OF SILVER WITH THE ELEMENTS OF THE B-SUB-GROUPS; by A. D. N. Smith. Feb., 1951. 21p. (RAE-R-MET-65)

An investigation has been made of the Young's modulus of binary alloys of pure Cu with Zn, Ga, Ge, and As, and of pure Ag with Cd, In, and Sn up to the limits of solid solubility. Measurements were made dynamically, and it is shown that in each case the modulus is reduced by an amount proportional to the atomic per cent of the solute element present. It is also shown that in addition to the rate of decrease being proportional to the square of the difference in atomic radii, as proposed by Zener, it is also proportional to the square of the valency of the solute element, the effects being additive. A close relation is found to exist between the rates of decrease of modulus and of solidus temperature for any given alloy of Cu or Ag, both for these results and for those published elsewhere. Results obtained by Köster for solid solutions of Au do not follow the same laws and this is ascribed to the behavior of the completely filled d-electron bands. A subsidiary investigation of the effect of cold work on pure Cu showed that there is first a sharp decrease in the modulus followed by a slow increase, which confirms results previously published by other workers. (auth)

7107
Armour Research Foundation
THE TITANIUM-COLUMBIUM, TITANIUM-MOLYBDENUM, AND TITANIUM-SILICON PHASE DIAGRAMS; by M. Hansen, H. D. Kessler, E. L. Kamen, and D. J. McPherson. June 1951. 126p. (AF-TR-6225)

The Ti-Nb, Ti-Mo, and Ti-Si systems were determined using alloys cast in consumable- and nonconsumable-electrode inert-atmosphere arc melting furnaces. Micrographic analysis after isothermal annealing followed by quenching was the chief method used for phase identification. X-ray diffraction was used to determine lattice constants and identify certain phases, and both thermal analysis and microscopic detection of incipient melting were used to locate melting temperatures, including those of the pure metals, Ti, Nb, and Si. The Ti-Nb and Ti-Mo phase diagrams were of the same type, having the following general features: Beta Ti and the added metal form a continuous series of solid solutions. A constantly rising solidus curve connects the melting points of the two metals. The $\alpha \rightarrow \beta$ transformation temperature is lowered with increasing Nb and Mo content, and the $\alpha + \beta$ field broadens at lower temperatures. The Ti-Si system is characterized by three intermetallic phases, Ti_5Si_3, TiSi, and $TiSi_2$ of which Ti_5Si_3 and $TiSi_2$ have maximum melting points and TiSi is formed by a peritectic reaction. There are three eutectics: (1) at 8.5% Si and 1330°C; (2) at 51% Si and 1490°C; and (3) at 78% Si and 1330°C. A eutectoid reaction occurs at 0.9% Si and about 860°C. The maximum solubility of Si in alpha Ti is 0.5% Si at the eutectoid temperature, and the maximum solubility of Si in β Ti is about 3% Si at the eutectic temperature, 1330°C. Vickers hardness data determined on the various alloys after annealing treatments and theoretical calculations of the $\beta/\alpha + \beta$ boundaries of the Ti-Nb and Ti-Mo systems are presented in an appendix.

7108
New Mexico Inst. of Mining and Tech., Socorro, N. Mex.
I. THE In-In_2S_3 SYSTEM; II. EQUILIBRIUM IN THE SYSTEM In_2O_3-H_2-In-H_2O; III. EQUILIBRIUM IN THE SYSTEM In_2S_3-In_2S_4-In_3S_5-InS-In; IV. POLAROGRAPHY OF INDIUM(III) (Technical Report No. 2); by M. F. Stubbs and J. A. Schufle. Sept. 1951. 39p. (NP-3435)

A study of the In-In_2S_3 system by thermal analysis has been completed. A phase diagram is presented. X-ray evidence confirms the instability of In_2S_4 and the nonexistence of In_2S in the temperature range studied. A study of equilibrium in the system In_2O_3-H_2-In-H_2O is presented. The standard heat of formation of In_2O_3 has been calculated to be −219 kcal at 291°K, and the standard free energy of formation of In_2O_3 to be −197 kcal at 298°K. X-ray evidence indicates that In_2O_3 is reduced in one stage directly to In by hydrogen in the temperature range 823 to 1123°K. A study of equilibrium in the system In_2S_3-In_2S_4-In_3S_5-InS-In is presented. The standard free energies of formation of the various sulfides at 298°K were calculated to be as follows: In_2S_3 = −101 kcal, In_2S_4 = −141 kcal, In_3S_5 = −220 kcal, InS = −39.3 kcal. The polarographic reduction of In(III) ions in solutions of 1N citric acid with varying added concentrations of sodium citrate has indicated the existence of a citrate complex, $In(H_2Cit)_4^-$ ion. (auth)

7109
DEVELOPMENT OF MICROSCOPIC CRACKS IN ALUMINUM DURING PLASTIC DEFORMATION. V. A. Pavlov. Doklady Akad. Nauk. S.S.S.R. 78, No. 4, 677-9(1951) June 1. (In Russian)

The process by which microscopic cracks originate along slip planes of Al during the period of plastic deformation is discussed briefly. 2 figures.

7110
BRAZED ALUMINUM HEAT EXCHANGERS. Modern Metals 7, No. 9, 25-8(1951) Oct.

An Al assembly, which is coated on one or both sides with a brazing alloy which is 92.5% Al and 7.5% Si, is preheated to a temperature just below the melting point of the brazing compound and plunged into a flux bath held at about 1100°F. Thorough cleaning completes the process.

7111
STRUCTURE OBSERVATIONS OF ALUMINUM DEFORMED IN CREEP AT ELEVATED TEMPERATURES. Italo S. Servi and Nicholas J. Grant. J. Metals (NY) 3, 917-22(1951) Oct.

In order to support the conclusions obtained from the examination of creep and stress rupture data of Al (Servi and Grant, J. Metals (NY) 3, 909-16(1951)), the deformed specimens were observed metallographically. The conditions of creep testing at which a change of slope occurs in the log-log plot of stress vs. minimum creep rate correspond to the beginning of grain-boundary flow (equicohesion), but are not directly related to the absence of slip bands. Grain-boundary migration occurs in high-purity Al tested under high-temperature conditions. Absence of slip bands occurs when the size of the grain is smaller than the average slip spacing. The deformation of Al is less localized the higher the temperature, or the slower the strain rate. The dimension, shape, and regularity of subgrains observed in high-purity Al suggest that the subgrains are related to the slip process or to other less known deformation processes such as kinking.

7112
BAILLIEU LABORATORY FOR METALLURGICAL RESEARCH. SUMMARY OF WORK CARRIED OUT AT BAILLIEU LABORATORY, UNIVERSITY OF MELBOURNE, DURING THE FIRST FIVE YEARS. J. Neill Greenwood. Chem. Eng. Mining Rev. 43, 413-20(1951) Aug. 10.

The metallurgical research projects carried out during the first five years of the Baillieu Laboratory of Melbourne are summarized. The topics covered are the extraction and properties of the rarer metals Ta, Ti, and Ti alloys; mechanism of deformation of metals; creep of Pb and Pb alloys; powder-metallurgy techniques; x-ray diffraction of crystal lattice; and thermal expansion.

7113
HOT-WORKABILITY OF STAINLESS STEEL IMPROVED BY ADDING CERIUM AND LANTHANUM. C. B. Post, D. G. Schoffstall, and H. O. Beaver. J. Metals 3, 973-977B, (1951) Nov.

The rare earths are effective in improving the hot-workability of austenitic, or partly austenitic, grades of stainless steels containing 4 to 70% Ni, and 10 to 60% of elements from the group of Cr, Mo, and W, the amount of any one element of this group not to exceed 30%. The Ni content determines the minimum and maximum amounts of Ce and La needed to obtain improvements in hot working. At any Ni content, a specific alloy can have a critical Ce and La content narrower than that indicated by the Ni content, but this content will be within the broad range determined by the Ni content and will be influenced primarily by such alloys as Mo, Cu, W, etc. Alloy additions of Ce and La in the range of about 0.02 to 0.04% are effective in promoting better hot-workability in high-frequency Ajax and basic electric arc-melted alloys such as Type 316, 310, 308, etc. Alloy additions of Ce and La in the range of 0.08 to 0.18% are effective in achieving hot-workability in such alloys as Carpenter No. 20 (Ni-Cr-Mo-Cu) and other high-alloyed stainless steels for corrosion resistance and high-temperature strength. (auth)

7114
EFFECT OF RARE-EARTH METALS ON THE PROPERTIES OF EXTRUDED MAGNESIUM. T. E. Leontis. J. Metals 3, 987-93(1951) Nov.

The specific effect of various rare-earth metals on the room- and elevated-temperature properties of magnesium has been evaluated. Alloys containing didymium exhibit the highest tensile and compressive strengths at room and elevated temperatures. All the rare-earth metals increase the creep resistance of extruded magnesium at temperatures in the range of 400 to 600°F, but the degree of enhancement depends on the temperature and on the concentration of the added metal. (auth)

7115
GRAIN-GROWTH AND RECRYSTALLIZATION CHARACTERISTICS OF ZIRCONIUM. F. J. Dunkerley, F. Pledger, V. Damiano, and J. Fulton. J. Metals 3, 1003-8(1951) Nov.

Grain-growth and recrystallization characteristics of a commercially pure zirconium prepared by the iodide process are reported. Grain growth from 640 to 800°C was continuous once initiated and obeyed $D = kt^n$. Recrystallization of zirconium occurred at temperatures of 450 to 550°C after deformations of 20 and 50 %. Hardening from partially soluble inclusions prevented determination of the absolute rates of recrystallization, but the relative rates of recrystallization obtained are useful as a guide in fabrication practice. (auth)

TRACER APPLICATIONS

7116
Massachusetts Inst. of Tech.
THE ADAPTION OF TRACER TECHNIQUES TO MINERAL ENGINEERING PROBLEMS; A. M. Gaudin, Director. Jan. 31, 1951. 29p. (NYO-591)

Tracer techniques have been applied in the following cases: Measurements of the change in pH of the water in sphalerite flotation tests indicated that no significant change occurred because of the addition to the water of various amounts of mercaptan. Results of tests of mercaptan adsorption on quartz mineral are shown graphically. Data are tabulated on quantity of dodecylamine acetate adsorbed on hematite at constant pH as the concentration of amine in aqueous solution was varied from 0.2 mg/liter to 1000 mg/liter. Experimental determinations of the amount of Ca adsorbed by pyrite have led to the following conclusions: Ca is adsorbed by pyrite but equilibrium between adsorbed Ca and Ca in solution is not reached within 7 hr contact time; the amount of Ca adsorbed increases with increase in pH; at solution concentrations greater than 14.5 mg of Ca/liter and contact time greater than 3 hr the amount of Ca adsorbed is sufficient to form a complete monolayer. The method used for determination of the amount of Na^+ adsorbed on quartz is described and results are tabulated. Methods being used to prepare polished thin sections of various minerals are described.

7117
LOGGING OF DRILL HOLES BY THE NEUTRON, GAMMA METHOD, AND GAMMA-RAY SCATTERING. Henry Faul and C. W. Tittle. Geophysics 16, 260-76(1951). Apr.

The hydrogen content, and hence the porosity, of drill-hole formations is measured at various depths by determining the line slope of log γ intensity vs. distance. Two γ detectors in a probe at fixed distances from a Po-Be neutron source measured the slope automatically.

PHYSICS

7118
Radiation Lab., Univ. of Calif.
PHYSICS DIVISION QUARTERLY REPORT; MAY, JUNE, AND JULY, 1951. Sept. 24, 1951. 29p. (UCRL-1474)

Separate Abstracts have been prepared on the following sections of this report: General Physics Research, p.3-10; General Physics Research, p.10-18; and Accelerator Operation and Development, p.19-25.

7119
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
PROGRESS REPORT; JANUARY 1, 1951. 69p. (NP-3437)

Separate abstracts have been prepared on the following sections of this report: Chemistry of the Fission Elements Group, p.1-5; Cosmic Ray, Elementary Particle Scattering, and 12-Mev Generator Construction and High Voltage Research Groups, p.6-17; Nuclear Chemistry (Inorganic) Group, p.19-29; Nuclear Chemistry (Organic) Group, p.30-3; Nuclear Cross Sections Group, p.34-42; and Radioactivity and Cyclotron Group, p.43-57.

7120
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF MAY 31, 1951; by Bonnie E. Cushman. Sept. 12, 1951. 11p. (UCRL-1352)

Work done at Cornell, Columbia, and Berkeley on meson scattering and absorption is briefly compared. The structure and mass-spectral patterns of oxygenated organic compounds were investigated. The polarity provided by the oxygen makes the results more easily analyzed. Double bonds also have a polarizing influence. Results are tabulated showing the principal peaks for various types of oxygen compounds. General results are: groups adjacent to the polarizing influence are the most reactive; the smallest group

containing the oxygen usually carries the charge; when competition occurs between polarizing groups one must look at the spectrum to draw conclusions; at present no quantitative measurements can be made. The construction of a 10-atm expansion cloud chamber is described. Three photographs are presented showing the completed chamber.

7121

Radiation Lab., Univ. of Calif.

ELECTROLYTIC TANK MEASUREMENTS IN THREE DIMENSIONS; by S. Softky and J. Jungerman. Sept. 13, 1951. 7p. (UCRL-1478)

A study of the electrolytic tank method was extended to 3-dimensional electric fields. To establish accuracy of results, a field was used which was calculable and confined in the sense that no field lines were present at the boundaries of the solution. Two opposing cylinders at +V and −V, having closed outer ends, defined the boundaries. Measurements of the potential were made at various longitudinal distances established to ±0.001 in. by the use of a micrometer and gage blocks. Proper probe construction was found to be essential for reliable results, and current was allowed to enter the probe only on its tip. A description of probe construction and a schematic drawing of the assembly is included. The axial component of the electric field was calculated by using linear and cubic interpolation of the measured and calculated points. Both interpolation methods gave the same fields within the accuracy of the measurements.

7122

Ames Lab.

PROGRESS REPORT IN PHYSICS FOR THE PERIOD JANUARY 1, 1951, TO JUNE 30, 1951; by G. W. Fox, W. C. Caldwell, J. F. Carlson, G. C. Danielson, E. N. Jensen, J. K. Knipp, J. M. Keller, L. J. Laslett, S. Legvold, G. Miller, and D. Zaffarano. Sept. 17, 1951. 36p. (ISC-175)

Separate abstracts have been prepared on the following sections of this report: Radiation Studies, Studies of Nuclei, and Theoretical Physics, p. 7-19; and Solid State Physics and Synchrotron Development, p. 20-34.

7123

Metallurgical Lab., Univ. of Chicago

CONTRACTION PRESSURE DEVELOPED BY SPLIT CYLINDRICAL SHELLS; by W. Karush and A. V. Martin. Aug. 28, 1944. Decl. Oct. 19, 1951. 10p. (AECD-3257; CP-2098(Rev.))

Calculations are made to estimate the pressure with which a split cylindrical shell tends to contract against internal restraint when heated in certain ways. (auth)

7124

Research Lab. of Electronics, Mass. Inst. of Tech.

QUARTERLY PROGRESS REPORT; by A. G. Hill, J. B. Wiesner, and G. G. Harvey. Oct. 15, 1951. 68p. (NP-3402)

Brief descriptions of apparatus constructed and experiments performed are reported by the following departments: Physical Electronics, Microwave Gaseous Discharges, Solid State Physics, Low Temperature Physics, Microwave Spectroscopy, Molecular Beam Research, Magnet Laboratory Research, Tube Research and Developmnet, Communication Research, and Analog Computer Research. Several circuit diagrams and graphs are shown, but few conclusive results are discussed.

7125

Sandia Corp.

SOME TESTS OF THE DIFFRACTION OF BLAST WAVES; by Melvin L. Merritt. June 7, 1951. Decl. Oct. 12, 1951. 79p. (AECD-3252)

A series of tests was conducted to measure the diffraction about a structure of shock waves from the detonation of high explosives. Two simple geometrically similar structures were used for the tests, each subject to blast waves of two different overpressures and two different durations. Pressure loadings during passage of the shock wave are presented, and conclusions are drawn from these data. An investigation of the effects of changes in overpressure alone would indicate that diffraction at one pressure is not necessarily similar to diffraction at another. 62 figures (auth)

7126

ELECTRON-CAPTURE CROSS SECTIONS FOR PROTONS PASSING THROUGH HYDROGEN GAS. F. L. Ribe. Phys. Rev. 83, 1217-25(1951) Sept. 15.

Measurements have been made of the electron-capture cross sections σ_c in hydrogen gas for protons moving with kinetic energies between 34 and 149 kev. At these energy limits, σ_c has the values 1.52×10^{-16} and 2.29×10^{-18} cm^2, respectively. Using the values of the electron-loss cross sections σ_l for hydrogen atoms in hydrogen gas recently measured, the ratio σ_l/σ_c was derived from the results of the present measurements. Direct measurements of this ratio agreed with the values derived from the separate measurements of σ_l and σ_c to within 10%.

In the present case σ_l/σ_c is unity at an ion velocity of 1.44 Bohr units ($e^2/\hbar$). This may be compared with the traversal of metals by protons, for which $\sigma_l/\sigma_c = 1$ is attained at 0.95 Bohr unit. (auth)

ASTROPHYSICS

7127

NEUTRON-CAPTURE THEORY OF ELEMENT FORMATION IN AN EXPANDING UNIVERSE. Ralph A. Alpher and Robert C. Herman. Phys. Rev. 84, 60-8(1951) Oct. 1.

The neutron-capture theory of element formation by non-equilibrium processes has been extended to include explicitly the effect of the expansion of the universe, and the resulting equations have been solved on an electronic digital computing machine. Inclusion of the universal expansion is found to require an increase by a factor of 5 of the density of matter chosen for the start of the element-forming process over that previously found necessary to represent the observed relative abundance distribution of elements in a static universe. The following physical conditions lead to agreement in the over-all trend of theoretical with observed abundances: the element-forming process is taken to start at ~140 sec after the "beginning" of the universal expansion; at this time the temperature is $\sim 1.3 \times 10^{9\circ}$K $\cong$ 0.11 Mev, the neutron-proton ratio is 7.33:1, and the density of matter is $\sim 0.9 \times 10^{-5}$ g/cm^3. (auth)

7128

ON CERTAIN NUCLEAR REACTIONS OF ASTROPHYSICAL IMPORTANCE. III. HYDROGEN SUDDENLY RAISED TO A TEMPERATURE OF SEVERAL MILLIARD DEGREES. P. Dumézil-Curien and E. Schatzman. Ann. astrophys. 14, No. 1, 46-53(1951). (In French)

An abstract of this paper appeared in Science Abstracts 54A, abstr. 6717(1951) Sept. and is reproduced here in its entirety.

The temperature of a region of a pure-H star is assumed to be raised suddenly by the passage of a shock wave. Possible nuclear reactions involving protons and electrons and the products of these reactions are discussed, and reaction velocities are determined. An estimate is made of the energy liberated per gram of matter. It is concluded that the nuclear processes considered are not sufficient to maintain the shock.

COSMIC RADIATION

7129

ON THE MASSES OF COSMIC RAY PARTICLES. S. Azimov, N. Birger, N. Dobrotin, G. Zhdanov, Yu. Kokurin, and S. Slavatinskiĭ. Doklady Akad. Nauk S.S.S.R. 78, No. 3, 447-50(1951) May 21. (In Russian)

Reports in the literature of observations of numerous particles with masses ranging from 110 to 20,000 m_e are criticized. Consideration of the experimental methods used indicate that the results may be explained without assuming other than accepted particles.

7130

ON THE ORIGIN OF THE COSMIC RADIATION. Giuseppe Cocconi. Phys. Rev. 83, 1193-5(1951) Sept. 15.

Experimental evidence of the isotropy of the cosmic radiation of energy above 10^{15} ev is given. The interpretation of this result leads to the inference that the more energetic particles of the cosmic radiation are not of solar origin, but come from the whole galaxy. On the other hand, a local origin seems necessary for the particles of moderate energy (10^9 to 10^{10} ev). (auth)

7131

THE HEAVY NUCLEI OF THE PRIMARY COSMIC RADIATION. P. S. Freier, G. W. Anderson, J. E. Naugle, and E. P. Ney. Phys. Rev. 84, 322-31(1951) Oct. 15.

The atmospheric absorption of the flux of nuclei of charge ≥10 has been obtained at $\lambda = 55°$ N from a combination of flux measurements at different altitudes and at different zenith angles. The absorption, together with the collision cross section, gives an energy spectrum consistent with the one measured by stopping particles and the latitude effect. The cross section for collision of heavy nuclei is about three-fourths of the geometric cross section. The energy spectrum can be represented by $Ne>E_0 \alpha 1/E_0^{\gamma}$, where γ is 0.5 for energies above 0.8 Bev/nucleon. N is the number of nuclei with an energy greater than E_0 per nucleon. The flux measured at $\gamma = 30°$ N gives an exponent $\gamma = 0.5$. At energies below about 0.75 Bev/nucleon the spectrum seems to get s steeper. The flux of heavy nuclei measured on two night flights shows no significant difference from the day flux. Solar activity resulting in flares of importance 1 and 2 shows no measurable correlation with flux of heavy nuclei. (auth)

7132

NUCLEAR BURSTS PRODUCED IN THE LOW ENERGY NUCLEONIC COMPONENT OF THE COSMIC RADIATION. J. A. Simpson, H. W. Baldwin, and R. B. Uretz. Phys. Rev. 84, 332-9(1951) Oct. 15.

The production rate of low-energy nuclear bursts or stars has been measured as a function of altitude and geomagnetic latitude, λ, at 0°, 40° N, and 52° N through 65° N. The measurements were obtained in aircraft using fast electron-collection pulse chambers. Exponential absorption paths, $L_b(\lambda)$, for the nuclear burst or star-producing radiation below ~200 g/cm² are $L_b(0°) = 214 \pm 7$; $L_b(40°) = 174 \pm 6$; $L_b(\geq 52°) = 164 \pm 14$ g/cm². Integral pulse-height distributions of nuclear bursts both at 0° and 52° are represented by $N_b = AV^{-2.5 \pm 0.1}$, where N_b is the number of burst pulses > bias energy V. A similar study of local showers produced in lead over the chambers at 0° and 52° shows a latitude factor of <1.1 and an exponential absorption of the shower-producing radiations at all latitudes of 134 ± 7 g/cm². The integral pulse-height distribution for showers was $N_s = BV^{-3.0 \pm 0.15}$. From the measurements it is concluded that (a) the small stars are produced in atoms by inelastic collisions and knock-on processes by nucleons and the average number rather than the average energy of the stars produced by high-energy nucleons increases with increasing primary nucleon energy, (b) the small nuclear bursts are in equilibrium with the fast neutron production in the atmosphere below ~200 g/cm² and these small bursts account for almost the entire fast-neutron intensity in the atmosphere, (c) these small stars and neutrons represent the low-energy limit of the nuclear stars is not strongly dependent on primary nucleon momentum above ~4 Bev/c. (auth)

7133

THE ABSORPTION OF EXTENSIVE SHOWERS IN WATER. Paul H. Barrett. Phys. Rev. 84, 339-44(1951) Oct. 15.

The absorption of the particles in extensive showers in water has been measured at 2765 m elevation by detecting coincidences between trays of Geiger counters located under water. Coincidence rates have been measured with counter-tray separations up to 5 m and at seven depths from 0 to 10 m of water. A theoretical calculation is shown to predict coincidence rates lower than those experimentally observed and further improvements in the calculations are suggested that might remove this discrepancy. If multiple cores exist in extensive showers, this experiment shows that they cannot be separated by more than 50 cm. The density spectrum and the spectrum of the number of particles in a shower have been calculated from the experimental results for elevations of 50 and 2765 m. (auth)

7134

ON THE NATURE OF THE V-PARTICLES. R. G. Sachs. Phys. Rev. 84, 305-7(1951) Oct. 15.

Disintegration of a neutral V-particle into a proton and negative meson strongly suggests that the V-particle is an excited state of the neutron. In order to account for the very long lifetime of this state, it is suggested that the nucleon has a very complex structure involving many mesons in virtual states. The excitation is then distributed over many degrees of freedom, so the probability for formation of that state which leads directly to disintegration may be very small. If n_0 is the average number of pions of each charge in the nucleon and f is the number of states available to a single pion, the lifetime for pion emission is estimated to be $t = fn_0^2 \times 10^{-23}$ sec. For the reasonable choice f = 10 and $n_0 = 4$ this agrees with the observed lifetime of the neutral V-particle. (auth)

7135

BEHAVIOR IN Pb OF THE NUCLEONIC COMPONENT IN THE STRATOSPHERE. Maurice M. Shapiro and Andrew F. Gabrysh. Phys. Rev. 84, 160-1(1951) Oct. 1. (Letter to the editor)

The behavior of the star-producing radiation in the stratosphere as it passes from air into Pb has been studied in two balloon-flight exposures. The geometry of the Pb block containing the nuclear emulsions was slightly different from that described by Shapiro et al. in Phys. Rev. 83, 455(1951). Similar features of the two experiments are a peak at ≈27 g/cm² and a slight initial decrease in frequency of the small stars. The major difference is the absence of the broad peak at ≈60 to 70 g/cm² in the present case. The transition effects must be strongly influenced by geometry.

7136

ON THE INTERACTION IN Pb OF THE SECONDARIES PRODUCED IN PENETRATING SHOWERS. G. M. Branch and G. Cocconi. Phys. Rev. 84, 146-7(1951) Oct. 1. (Letter to the editor)

The collision mean free path (m.f.p.) in Pb of the secondary particles produced in penetrating showers has been measured. The measurements were made by means of a dual cloud-chamber assembly at Echo Lake, Colo. (altitude 3260 m). Corrections to the observed m.f.p. were made with the aid of a distribution graph of nuclear interactions in the Pb plates. The real collision m.f.p. is then deduced as 172 ± 29 g/cm² of Pb. (See also the following abstract.)

7137
A DUAL CLOUD-CHAMBER STUDY OF EXTENSIVE AIR SHOWERS. G. M. Branch. Phys. Rev. 84, 147-8(1951) Oct. 1. (Letter to the editor)

Cloud-chamber photographs of penetrating particles in extensive air showers have been obtained at Echo Lake, Colo. (see preceding abstract). The photographs demonstrate the occurrence of strongly interacting nucleonic particles in air showers and also show that nuclear cascades contributing to the electronic-cascade development exist within air showers at mountain altitudes. The projected angular distribution of penetrating particles relative to their corresponding air-shower axes was measured in 173 selected photographs. At angles of less than 10° in projection 92% of the observed penetrating particles are coherent with air showers. About three-fourths of the coherent penetrating particles are deviated less than 3° from the shower axis and hence have momenta greater than 2 Bev/c. 155 ± 5 coherent externally incident penetrating particles (parallel to the shower axis within 10°) were observed to make 606 ± 20 traversals of Pb plates in the lower chamber, producing three local penetrating showers and two local mixed showers. The fraction of energetic N component in the flux of air-shower penetrating particles incident on the apparatus is estimated to be 26 ± 10%. Examples of photographs of air showers containing strongly interacting particles are shown.

7138
COSMIC-RAY STAR PRODUCTION IN ARGON AT SEA LEVEL. W. W. Brown and E. W. Hones. Phys. Rev. 83, 1263-4(1951) Sept. 15. (Letter to the editor)

The sea-level rate of cosmic-ray star production in argon has been measured by direct observation of the N-ray nuclear interactions in the gas of an ionization chamber contained in a cloud chamber. Only those bursts releasing more than 7 Mev were permitted to trigger the chamber. Oscillograph traces of the ionization-chamber pulses were photographed. The corrected rate of star production in argon is 0.78 ± 0.13 g/day and 0.57 ± 0.13 g/day for one or more and three or more prongs, respectively. If charged and neutral N rays have the same mean path for nuclear interaction, about 5% of the sea-level N rays are charged.

7139
ORIGIN OF COSMIC RAYS. G. P. Dishkant. Priroda, No. 4, 21-7(1951). (In Russian)

A nontechnical discussion of the various hypotheses on the origin of cosmic rays is presented.

7140
COSMIC RAYS AT AIRPLANE ALTITUDES. A. T. Biehl and H. V. Neher. Phys. Rev. 83, 1169-74(1951) Sept. 15.

A continuation of experiments made in a B-29 airplane to investigate the properties of cosmic rays is herein reported. Part I describes results on the latitude effect at 30,000 ft measured with counter telescopes and with both shielded and unshielded ionization chambers, from 64° geomagnetic north to the magnetic equator. A considerably larger latitude effect for the shielded ionization chamber than with the unshielded one or with counter telescopes indicates a definite change in the character of the radiation as one goes toward the equator at this altitude. The "knee" of the latitude effect is investigated in detail by a number of similar flights. Part II describes measurements made on density and formation of extended air showers. The apparatus was of such a nature as to be sensitive to relatively sparse showers. The densities obtained can be fitted to an integral power law spectrum with a negative exponent of 1.50 ± 0.05 for an altitude of 30,000 ft. Intensity-altitude curves are presented, showing that the development of smaller showers takes place nearer the top of the atmosphere than does the development of large showers. Derived zenith-angle dependencies at various altitudes are also given. (auth)

7141
NEUTRONS PRODUCED IN THE ATMOSPHERE BY THE COSMIC RADIATIONS. J. A. Simpson. Phys. Rev. 83, 1175-88 (1951) Sept. 15.

The distribution of disintegration-product neutrons in the atmosphere has been measured from the geomagnetic equator to 65°N and up to ~220 g/cm² air. The measured exponential absorption of the neutron producing radiations in the equilibrium portion of the atmosphere is: L(0°) = 212, L(19°) = 206, L(40°) = 181, L(53°) = 157, L(65°) = 157 g/cm². It is shown that the neutron component has the largest latitude effect of any known secondary component in the cosmic rays and that the neutrons are part of a low energy nucleonic component in the atmosphere. The yield of neutrons per incident primary particle in an air column 1 cm² area extending through the atmosphere has been calculated at various latitudes. The yield increases by 400% between 0° and 55°N. The slow neutron absorption in air at the geomagnetic equator under 312 g/cm² air was measured. It is concluded that nucleon collision chains in the atmosphere are the principal process by which a low energy nucleonic and neutron component is produced. Measurements at high latitudes over a period of two years have shown that fluctuations and large changes of intensity of the neutron component may occur during solar and terrestrial disturbed days. (auth)

7142
ABSORPTION LENGTH AND COLLISION LENGTH OF HARD-SHOWER-PRODUCING RADIATION. David Pomeroy. Phys. Rev. 84, 77-83(1951) Oct. 1.

By combining techniques of coincidence counter circuits and nuclear photographic emulsions, values are obtained for the absorption length in air of 104 ± 6 g/cm², and for the collision length in paraffin of 61 ± 6 g/cm² for hard-shower-producing radiation. The method also provides evidence of a cascade mechanism by which the hard showers are produced. (auth)

7143
THE PENETRATION OF PARTICLES ASSOCIATED WITH COSMIC-RAY STARS. II. J. A. Northrop. Phys. Rev. 84, 83-9(1951) Oct. 1.

A second series of measurements has been made at Climax, Colo. (elevation 3510 m), of the particles associated with nuclear explosions, or stars, in a thin-walled ionization chamber. The associated particles were detected by observing coincidences between the ion chamber and appropriately placed trays of Geiger counters. The experiment was planned in such a way as to distinguish between those particles which are products of nuclear disintegrations which emerge from the ion chamber and those particles which are incident in the atmosphere in association with the particles producing the stars. Absorption measurements were made of both the low-energy and penetrating product particles. There was no conclusive evidence indicating the presence of electrons or photons among the disintegration products. The absorption mean free path in lead was not exponential but increased to 190 ± 40 g/cm² at the maximum of 8 in. Pb. Absorption measurements of the associated particles which are not disintegration products of the stars indicate that they are parts of local penetrating showers having mean free paths greater than 500 g/cm². Absorber placed over the ion chamber produced bursts of electrons in the chamber whose number greatly exceeded that of extensive air showers. These bursts have been tentatively identified with narrow air showers. (auth)

7144
NUCLEAR DISINTEGRATIONS INDUCED BY μ MESONS. G. Cocconi and V. Cocconi Tongiorgi. Phys. Rev. 84, 29-36 (1951) Oct. 1, 1951.

The absorption curve in water of the cosmic radiation producing nuclear disintegrations was obtained by recording the neutron showers occurring in an absorber surrounded by BF_3 counters. It was found that, while the N component of the cosmic radiation is responsible for most of the disintegrations observed under the first few meters of water, μ mesons are the particles causing either directly or indirectly most of the events recorded at depths greater than ~10 m water. The cross section of μ mesons for nuclear interactions is found to be $\sim 1 \times 10^{-29}$ cm^2/nucleon at a depth of 20 m water. Estimates of the absolute intensity of the N component and of the relative contribution to nuclear disintegrations by μ mesons and N component at sea level are given. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

7145

Iowa State Coll.

ELECTROSTATIC FIELDS IN CLOSE-PACKED CRYSTALS; by L. Lorne Campbell, Joseph M. Keller, and Ernest Koenigsberg. Oct. 30, 1951. 4p. (ISC-179)

The electrostatic field potentials of metals in hexagonal close-packed and cubic face-centered crystals are calculated for the 2nd, 3rd, and 4th degree spherical harmonics. In order to determine the magnitudes of spherical harmonics up to the 4th degree, the metal was assumed to be a collection of positive point charges of magnitude q at the ion sites, superimposed on a uniform negative charge of density ρ.

ELECTRICAL DISCHARGE

7146

Los Alamos Scientific Lab.

THE INITIATION OF ELECTRICAL BREAKDOWN IN VACUUM; by Lawrence Cranberg. [nd] 18p. (AECU-1672; LADC-1059)

The hypothesis is suggested that initiation of high-voltage breakdown in vacuum is due to traversal of the high-voltage gap by a clump of loosely adhering material. The implication of this hypothesis for uniform-field gaps is that the breakdown voltage is proportional to the square root of the gap length. A summary of the literature is presented which supports this conclusion for a range of voltages from 10 kv to 7 mv, and for a range of gaps distance from 0.2 mm to 6 meters. Additional qualitative evidence is presented which tends to support the proposed hypothesis. (auth)

ELECTRONS

7147

ON THE THEORY OF THE ELECTRON. II. Walter Wessel. Z. Naturforsch. 6a, 478-83(1951) Sept. (In German)

The program of determination of the mass operators proposed in I (Wessel, Z. Naturforsch. 1, 622(1946), reprinted in FIAT-1131; NSA 3-1024) is brought to a conclusion with certain limitations. The differential equations found by classical means agree with a quantum-theoretical condition discovered in the meantime (Wessel, Phys. Rev. 76, 1512 (1949); NSA 4-568). One of ten new identities in Dirac algebra is necessary for the development.

7148

ON RELATIVISTIC QUANTUM MECHANICS. II. Walter Wessel. Z. Naturforsch. 6a, 473-7(1951) Sept. (In German)

The infinite, hermitian representation of the matrix apparatus of the electron theory given in I (Wessel, Z. Naturforsch. 4a, 645(1949); NSA 4-3838) led to a point of accumulation at zero of the eigenvalues of all regular mass operators. Various representations are given in which the mass operator appears in diagonal form, while the remaining operators take the form of integral or simple difference operators. (See also Wessel, Phys. Rev. 33, 1031-7(1951) Sept. 1; NSA 5-6267.)

7149

THE QUESTION OF A MASS DIFFERENCE BETWEEN ELECTRON AND POSITRON. H. Salecker. Z. Naturforsch. 6a, 484-6(1951) Sept. (In German)

Recent observations on a difference between the annihilation energies of electron and positron (DuMond, Phys. Rev. 81, 468(1951); Hedgran and Lind, ibid., 82, 126(1951)) have suggested the question of whether present-day quantum field theory is capable of proving the existence of a mass difference responsible for these observations. It is shown by the theory of β decay that the assumption of the nonexistence of a negative proton as an elementary particle leads to such a difference. In turn, these observations combined with the assumption of exact equality of electron and positron mass suggest the existence of a negative proton.

7150

THE FOURTH-ORDER CONTRIBUTION TO THE SELF-ENERGY OF THE ELECTRON. R. M. Frank. Phys. Rev. 83, 1189-93(1951) Sept. 15

The self-energy of a free electron is calculated to order e^4. The modification of quantum electrodynamics suggested by Feynman is used to make the matrix elements finite. After mass renormalization, using the self-energy to order e^2, there remain four Feynman diagrams whose matrix elements must be calculated. Two of these represent the two ways in which two virtual quanta may be emitted and absorbed by the electron, both quanta being present at the same time. The third diagram represents the emission of a virtual quantum which creates a virtual pair, the quantum produced by the pair annihilation being absorbed by the electron. The last diagram corresponds to the emission and absorption of a virtual quantum accompanied by a mass renormalization.

The matrix elements involve an integration over the momenta of all virtual quanta present in each diagram. These integrals are approximated by assuming that the Feynman cutoff, λ, is large compared to the electron mass.

It is found that the result depends upon $(\ln\lambda)^2$, but it is not the square of the second-order self-energy. (auth)

7151

THE RANGE AND STRAGGLING OF HIGH ENERGY ELECTRONS. Robert R. Wilson. Phys. Rev. 84, 100-3(1951) Oct. 1.

Simple expressions are derived for the range and straggling of individual electrons. Large energy losses due to bremsstrahlung make the average range smaller than would be calculated from the average energy loss. Effects of multiple scattering are included. The results are in good agreement with numerical calculations by the Monte Carlo method. (auth)

GASES

7152

CATALYTIC AMMONIA OXIDATION AND RAPID CATALYTIC PROCESSES. XV. COMPUTATION OF GASEOUS DIFFUSION IN TUBES AND LATTICES. Leonid Andrussow. Angew. Chem. 63, 350-5(1951) Aug.

Exchange of gaseous components flowing through tubes where catalytic processes take place on the walls is investigated. In fact reactions, gaseous diffusion determines the rate. Equations are given which determine the gaseous exchange as dependent on the speed of flow, the coefficient of diffusion, the reacting component, and the dimensions of the tube. It is concluded that with constant speed of flow the tube length has to increase with the square of the diameter to reach a defined exchange. The results are applied to catalysis on a series of lattices. NH_3 oxidation on fine wire lattices takes place mainly with molecular O_2.

INSTRUMENTS

7153
North American Aviation, Inc.
MEASUREMENT OF RESISTIVITY CHANGES DURING PULSE-ANNEALING; by P. C. Stello. Oct. 29, 1951. 23p. (NAA-SR-118)

An apparatus is described which was used to study rate processes in solid conductors by a method termed "pulse-annealing." The sample is annealed for a short period of time and quickly cooled, and its electrical resistivity measured at a fixed base temperature. This procedure is repeated to simulate any desired time-temperature history, while the sample remains permanently mounted in a vacuum system. Examples of two types of experiments which have been performed with the apparatus are given. They are isothermal annealing studies of the ordering and the disordering reaction in AuCu and a "tempering" study to determine the resistance changes of gas-baked carbon during graphitization. (auth)

7154
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF MARCH 29, 1951; by Bonnie E. Cushman. Sept. 10, 1951. Decl. Oct. 26, 1951. 7p. (AECD-3262; UCRL-1217)

A mass spectrograph based on a time-of-flight principle is briefly described. Ions from a thermal source are accelerated by a parallel electrostatic field down a drift tube and their time of flight, which varies with mass, is measured. The ions arrive in bunches at the end of the tube where they are separated by the pulse applied to the second grid. The apparatus is described in UCRL-636. The second part of the report is concerned with recent applications of another type of time-of-flight apparatus for identifying high-energy particles. The time of flight of a proton between two scintillation counters was used to measure the neutron spectrum from a cyclotron Be target. Similar arrangements are briefly described for detection of π^- mesons at the cyclotron, meson detection at the synchrotron, and proton counts from γ-p reactions.

7155
Los Alamos Scientific Lab.
MAGNET CALIBRATION BY THE FLOATING-WIRE METHOD; by Lawrence Cranberg. [nd] 17p. (AECU-1670; LADC-1062)

A method is discussed for determining the momentum of a beam of charged particles, bent by a magnetic field, from the ratio of tension to current in a current-carrying wire which follows the same path in the field as the particles. Details are given of the calculations and apparatus necessary for realization of a precision of a few hundredths of 1% in the measurement of momentum. (auth)

7156
North Carolina State Coll.
THE MEASUREMENT OF THERMAL PROPERTIES OF NON-METALLIC MATERIALS AT HIGH TEMPERATURES; PROGRESS REPORT NO. 1, COVERING PERIOD JULY 1, 1951–SEPTEMBER 30, 1951; by K. O. Beatty, Jr. Oct. 1, 1951. 15p. (AECU-1671)

Prelimary plans for a new type of apparatus for measuring the thermal properties of poor conductors at elevated temperatures, including discussions of general apparatus design and materials of construction, are presented. No data are reported.

7157
General Electric Research Lab.
THE CONSTRUCTION AND OPERATING OF A HIGH-TEMPERATURE CALORIMETER; by R. A. Oriani. Sept. 1951. 23p. (SO-2017; RL-586)

The construction and operating details of a high-temperature, high-precision calorimeter for the measurement of enthalpy as a function of temperature are described. The precision and accuracy of the apparatus were determined by its use on high-purity alumina and found to be quite satisfactory. The possibilities of using the calorimeter for the determination of various properties through heats of solution are discussed. (auth)

7158
Knolls Atomic Power Lab.
MAGNETIC FLOWMETER CALIBRATION RESULTS; by W. Curtis Gray. Oct. 3, 1951. 9p. (KAPL-613)

Calibration tests on a magnetic flowmeter were made using a flow loop and weigh tank. A linear relationship was obtained in four graphs plotting flowmeter output voltage against actual flow (gal/min). Excellent agreement with theoretical output was obtained. Thus the present theoretical equations can be used for predicting flow with very good results.

7159
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR PULSE GENERATOR TYPE 1012B (Cat. No. 3-7/5379). [nd] 23p. (NP-3414)

Operating and maintenance information is given for the pulse generator type 1012B which is designed for the measurement of the resolution and paralysis times of the scaling unit type 200-200A. Two pulses are produced, a single delayed pulse at a repetition frequency of 100/sec of ~2 μsec width either positive or negative, being delayed from the trigger pulse. The spacing between the two pulses may be varied from 3 μsec to 3 msec with an amplitude from 0 to 4 v.

7160
Atomic Energy Research Establishment, Harwell, Berks (England)
FLUORIMETER TYPE 1080A (Cat. No. 3-7/5104); INTERIM MANUAL. [nd] 20p. (NP-3427)

7161
Atomic Energy Research Establishment, Harwell, Berks (England)
PULSE GENERATOR TYPE 1013C; INTERIM MANUAL. [nd] 16p. (NP-3412)

7162
Atomic Energy Research Establishment, Harwell, Berks (England)
AMPLIFIER TYPE 1031B; INTERIM MANUAL. [nd] 18p. (NP-3421)

7163
Atomic Energy Research Establishment, Harwell, Berks (England)
COINCIDENCE UNIT TYPE 1035B; INTERIM MANUAL. [nd] 15p. (NP-3424)

7164
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR POWER SUPPLY UNIT, TYPE 1082A (Cat. No. 3-7/5164). [nd] 32p. (NP-3429)

Working instructions are given for power-supply unit type 1082A which is designed to provide a stable positive or negative voltage source for operating G-M counters and ionization chambers. The unit provides a stable output voltage up to 3 kv in four ranges, i.e., 200 to 500 v, 400 v to 1 kv, 800 v to 2 kv, and 1.6 to 4 kv.

7165
Atomic Energy Research Establishment, Harwell, Berks (England)
POWER UNIT TYPE 1033A AND 1140A (Cat. No. 3-7/4354 and 3-7/6867); FINAL MANUAL. [nd] 40p. (NP-3430)

Working instructions are given for power-supply unit type 1033A which was designed for use with photomultipliers, proportional counters, G-M counters, and ionization chambers where a very stable source of high voltage, free from ripple and pulses, is required. The power unit produces a continuously variable stabilized voltage of from 500 to 3000 v at a positive or negative potential.

7166
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR PROBE UNIT TYPE 200 (Cat. No. 3-7/0003). [nd] 19p. (NP-3408)

Technical description, operating conditions, and maintenance problems are given in this working instruction manual for the probe unit type 200, designed to amplify negative pulses from G-M counters which are to weak to operate the scaling unit type 200 and 200 A directly.

7167
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR PROBE UNIT TYPE 1014A (Cat. No. 3-7/4189). [nd] 24p. (NP-3405)

Technical description, operating conditions, and maintenance problems are given in this working instruction manual for the probe unit type 1041A. This probe unit was designed to reduce the potential applied to the center wire of a G-M counter by 240 volts for a known period following each registered pulse, and also to provide an output pulse suitable for operating scaling units type 200 or 200 A.

7168
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR PULSE AMPLIFIER TYPE 1008 (Cat. No. 3-7/3742); AND H. F. HEAD AMPLIFIER TYPE 1008 (Cat. No. 3-7/3743); AND L. F. HEAD AMPLIFIER TYPE 1008 (Cat. No. 3-7/3744). [nd] 58p. (NP-3404)

Technical description, operating conditions, and maintenance problems are given in this working instruction manual for the pulse amplifier type 1008. This amplifier is a general purpose linear a-c amplifier for use with pulse ionization chambers or proportional counters and consists of two head amplifiers (h-f and l-f) each having a gain of 100 and a main amplifier unit having a maximum gain of 16,000.

7169
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR POWER UNIT, TYPE 200 (Cat. No. 3-7/0002). [nd] 32p. (NP-3415)

Working instructions for power unit 200 are given. The power unit provides a stable voltage source for operating G-M counters and ionization chambers from a 200- to 250-v 50-cps supply. The unit provides a stable output voltage up to 4 kv in four ranges, i.e., 200 to 500 v, 400 v to 1 kv, 800 v to 2 kv, and 1.6 to 4 kv.

7170
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR POWER UNIT TYPE 1007 (Cat. No. 3-7/0270) POTENTIOMETER UNIT TYPE 1007 (Cat. No. 3-7/0271). [nd] 31p. (NP-3416)

Operating and maintenance information is given for the power unit type 1007 and potentiometer type 1007. The power unit is designed for use where a number of G-M counters or ionization chambers are being operated simultaneously, thus eliminating the necessity of an individual stabilized power supply for each counter or chamber. The power unit supplies a positive or negative fixed stabilized voltage, which is fed to the potentiometer units, and then on to operate the G-M counters or ionization chambers.

7171
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR SCALING UNIT TYPE 200 (Cat. No. 3-7/0001); SCALING UNIT TYPE 200A (Cat. No. 3-7/3746). [nd] 47p. (NP-3417)

Operating and maintenance information is given for the scaling unit types 200 and 200A which are designed to register the number of pulses arriving in a random manner over a period of time. The design consists of two electronic scales-of-ten with neon indicators followed by a mechanical counter of four digits; thus a six-figure number can be registered. The mechanical counter is a post office telephone call meter and is capable of operating at 5 pulses/sec. The electronic scaling circuits will operate from pulses spaced by at least 5 μsec.

7172
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR TIMING UNIT TYPE 1003 (Cat. No. 3-7/2971). [nd] 44p. (NP-3413)

Operating and maintenance information is given for the timing unit type 1003 which is designed as an accessory to the scaling unit type 200. The unit can be used either to measure the time taken to complete a predetermined number of counts or to give the number of pulses counted in a predetermined interval of time. The design consists of a group of 3000 telephone-type relays functioning as two scales-of-ten in series, a resettable electromechanical register, and a source of time impulses.

7173
PRODUCTION OF SMALL APERTURES BY AN EVAPORATION TECHNIQUE. A. S. Baxter. Vacuum 1, No. 2, 115-17(1951) Apr. (Letter to the editor)

Holes as small as 1 μ in diameter may be produced readily in metal foils a few thousand angstroms thick by evaporating the metal (Ag, Au, Ni, Al, etc.) onto a stripping film on which rests an electrolytically pointed and polished needle. The ring source surrounds the needle, so that a uniform layer is achieved. Mass production is possible.

7174
THE DETECTION OF RADIATION. Ralph T. Overman. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.48-55.

Detection of radiation by collection of ions produced by the interaction of the various types of radiation with matter is discussed. Topics treated include measurement of background radiation, integrating ionization chambers, current measurement with integrating ionization chambers, nuclear counters, ionization-chamber counters, proportional counters, G-M counters, Geiger-tube quenching, operational plateaus, scintillation counters, the registering of counter impulses, and detection of radiation with photographic film.

ISOTOPES

7175
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF AUGUST 23, 1951; by Sergey Shewchuck. Sept. 17, 1951. 5p. (UCRL-1481)

Investigations of isotopes in the region of 82 neutrons have shown α emitters in the rare-earths region of 82 to 86 neutrons; namely, Sm, Gd, Eu, and Tb. The highest energy of the α emitters is from the 84-neutron isotopes whose 82-neutron daughters apparently have closed shells. Studies of the β-decay properties of Eu isotopes were made in the low neutron range. Sm isotopes were bombarded at the 60-in. cyclotron and linear accelerator, yielding isotopes of up to 70% purity after separation by ion-exchange and chemical-reduction techniques. All isotopes of Eu from Eu^{144} to Eu^{150} were formed. Eu^{151} and Eu^{153} were determined to be stable. The half life of Eu^{149} was determined to be 120 days. A sharp discontinuity was noted between Eu^{145} and Eu^{144}, which was attributed to the closed shell of the 82-neutron configuration and its consequent rise in neutron binding energy. A possible curve for the neutron binding energy in the region of 82 neutrons is presented.

7176

I^{129} AND THE AGE OF THE ELEMENTS. H. E. Suess and Harrison Brown. Phys. Rev. 83, 1254-5(1951) Sept. 15.

In a recent paper Katcoff et al. (Phys. Rev. 82, 688(1951)) reported the half life of I^{129} to be $1.72 \pm 0.09 \times 10^7$ yr, and they concluded that the time interval from the formation of the elements to the formation of the earth's atmosphere was 2.7×10^8 years. This conclusion was based on the assumption that at least a noticeable fraction of the Xe^{129} in the present atmosphere originated from radioactive decay of I^{129}. It is now shown that radiogenic origin of Xe^{129} cannot be proved because the abnormal abundance of Xe^{129} can be explained in a way other than by assuming a radiogenic origin. Instead of an abnormal abundance of Xe^{129}, the abundances of Xe^{128} and Xe^{130} may be abnormally low because of "shielding" by stable Te isotopes. Therefore the value of 2.7×10^8 yr should be interpreted only as a lower limit for the time interval between the formation of the elements and the formation of the earth's atmosphere. It is pointed out that a lower limit of 4×10^8 yr may be more likely.

7177

CONTROL OF RADIOISOTOPE DISTRIBUTION. S. Allan Lough. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.122-5.

Policies governing the allocation of radioisotopes by the Atomic Energy Commission, as administered by the Isotopes Division, for laboratory, industrial, and medical uses are explained. Work of the Isotopes Division in promoting and at the same time controlling the use of radioisotopes is discussed. A brief summary is given of services available from the Isotopes Division, such as consultation, advisory field service, and technical information.

ISOTOPE SEPARATION

7178

CONCENTRATION OF Li^6 BY ELECTROLYTIC TRANSFERENCE IN MOLTEN LiCl. Alfred Klemm. Z. Naturforsch. 6a, 512(1951) Sept. (Note; in German)

An apparatus is sketched in which molten LiCl was electrolyzed between graphite electrodes for 4.2 days with a 0.5-amp current. The inner diameter of the separation tube was 5.6 mm. After the decomposition, 1.0 g of LiCl was recovered from the cathode space and mass analyzed. The Li^6 concentration was $16.1 \pm 0.3\%$ as contrasted to 7.3% in natural Li, a separation factor of 2.4.

7179

CONCENTRATION OF THE LIGHT ZINC ISOTOPES BY ELECTROLYTIC TRANSFERENCE IN MOLTEN ZINC CHLORIDE. Alfred Klemm, Heinrich Hintenberger, and Arnold Lundén. Z. Naturforsch. 6a, 489-94(1951) Sept. (In German)

The cell carbon/Pb/$PbCl_2$/$ZnCl_2$/Cl_2/carbon$^+$ was electrolyzed for 3 days with 230 ma (current density 4.27 amp/cm^2) at a temperature of 650°C, the resulting displacement of the Zn ion relative to the Cl ion being 340 cm. At the boundary between the $PbCl_2$ and $ZnCl_2$ the Zn isotopic ratio was shifted to the light isotopes. A separation factor of 3.19 was obtained for the $Zn^{64}-Zn^{70}$ isotope pair between the best sample (59 mg of Zn) and the natural isotopic mixture. The mass effect $\mu = \Delta w/w/\Delta m/m$ for the ionic transport velocity w and isotope mass m was determined as -0.078 for Zn isotopes in $ZnCl_2$.

7180

THE ISOTOPIC EFFECT IN ELECTROLYTIC CATION MIGRATION IN HALOGENIDES. Alfred Klemm. Z. Naturforsch. 6a, 487-8(1951) Sept. (In German)

The mass effect $\mu = \Delta w/w/\Delta m/m$, where w is the migration velocity and m is the isotope mass, for the migration of the cations in molten LiCl, $ZnCl_2$, $CdCl_2$, TlCl, and solid (230°C) α-AgI may be closely estimated by the equation $\mu = -0.15(2.1m^-/(2.1\ m^- + m^+))$, where m^- is the mass of the halogen atom and m^+ that of the metal atom.

MASS SPECTROGRAPHY

7181

MASS SPECTROMETRY. p.587-639 of PHYSICAL METHODS IN CHEMICAL ANALYSIS. Vol. I. Walter G. Berl, ed. New York, Academic Press, Inc., 1950. 664p.

The mass spectrum and factors that determine its characteristics are discussed, apparatus and methods of analysis are described, and examples of application to chemical-reaction kinetics and mechanism, bond-strength determination, and hydrocarbon-mixture analysis are given. 73 references.

MATHEMATICS

7182

STATISTICAL SIGNIFICANCE OF SMALL SAMPLES OF COSMIC-RAY COUNTS. Victor H. Regener. Phys. Rev. 84, 161-2(1951) Oct. 1. (Letter to the editor)

In order to draw tentative conclusions from a small total number of counts, n, the use of the standard deviation of a gaussian distribution should be replaced by a similar procedure based on the Poisson distribution. However, the quoted statement of probability also contains the illegitimate assumption of a constant a priori probability for the existence of the average count on both sides of the value n. This difficulty is briefly examined for the Poisson distribution, and appropriate precision limits for low values of n are given.

MEASURING INSTRUMENTS AND TECHNIQUES

7183

Oak Ridge National Lab.

A NUCLEAR PLATE CAMERA FOR FAST NEUTRON SPECTROSCOPY AT THE BULK SHIELDING FACILITY; by J. L. Meem and E. B. Johnson. Issued Sept. 14, 1951. Decl. Nov. 1, 1951. 16p. (AECD-3266; ORNL-1046)

In this camera the neutrons enter through a collimator and strike a hydrogenous radiator, ejecting recoil protons. The protons produce tracks in an appropriately placed nuclear plate, and the track lengths are measured. From the track length the energy of the proton and consequently the energy of the neutron which produced it can be calculated. A rough check on the U^{235} fission spectrum has established the feasibility of the method. Sketches and photographs of the instrument are included.

7184
Ames Lab.
CHARACTERISTICS OF A DIAMOND CONDUCTION COUNTER; by Robert Kent Willardson and G. C. Danielson. Dec. 1950. 79p. (ISC-163)

A critical discussion is given of the optical properties of a diamond and their relationship to its counting characteristics. The counting rate of a diamond counter is shown to be strongly dependent upon the wavelength of the light irradiating the diamond. Red (or infrared) light removes the polarization due to trapped charge carriers while violet (or ultraviolet) light results in an "activated" condition in which the counting rate appears to be independent of polarization effects. When counting γ rays, "activation" may take place due to the γ radiation alone and this may result in spectacular increases in counting rate. An explanation of these effects in terms of the ionization of a donor level 3 ev below the conduction band is given. By using the space charge field for counting, the location of discrete trapping levels can be determined. By supplementing this information with spectroscopic data, including a new absorption maximum in the infrared, a tentative list of known trap depths has been established. Theoretical curves showing the variation of pulse height with region of the crystal bombarded emphasize the difficulty of using diamonds for measuring the energy spectrum of the incident nuclear particles. (auth)

7185
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR RADIATION MONITOR BETA-GAMMA TYPE 1005 (Cat. No. 3-7/0071) AND TYPE 1005A (Cat. No. 3-7/3607). [nd] 47p. (NP-3431)

Operating and maintenance information is given for the β-γ radiation monitor types 1005 and 1005A which are battery-operated portable units intended for the measurement of β- and γ-radiation intensities for health-tolerance purposes. Range reception for the units are 0 to 0.06, 0 to 0.6 (for γ radiation), and 0 to 6r/8hr.

7186
Atomic Energy Research Establishment, Harwell, Berks (England)
RATEMETER TYPE 1048A (Cat. No. 3-7/5071); FINAL MANUAL. [nd] 28p. (NP-3428)

Technical description, operating instructions, and maintenance problems are given for the Ratemeter type 1048A, designed to detect and measure variations in the γ-ray intensity over the surface of the earth, such as might be produced by concentrations of radioactive minerals. The radiation detector is a G-M tube which produces an electrical impulse each time it is triggered by a γ ray. These impulses are passed to an amplifying circuit which produces a current whose magnitude is related in a fixed known manner with their mean rate of occurrence, this current being measured audibly and by a microammeter.

7187
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR MONITOR, ALPHA-HAND TYPE 1024 (Cat. No. 3-7/4150).

Operating and maintenance information is given for the α hand monitor type 1024 which is designed to automatically check the hands of workers handling α-active materials (U ore) for α contamination. The monitor indicates visually the degree of contamination on both hands simultaneously and when the contamination exceeds a recognized safe level an audio warning is given.

7188
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR MONITOR, C.R.O. TYPE 1017 (Cat. No. 3-7/3791). [nd] 50p. (NP-3426)

Technical description, instructions, and maintenance problems are given for the monitor C.R.O. 1017 consisting of the C.R.O. indicator unit, power unit, and follower unit. The monitor is a high-speed pulse-triggered oscilloscope, and the time base is arranged to trigger on a positive or negative edge of at least 25 volts amplitude. The time-base sweep commences less than 0.25 μsec after the triggering edge.

7189
Atomic Energy Research Establishment, Harwell, Berks (England)
PHILIPS BETA GAMMA RADIATION MONITOR MK.II TYPE 39991/13 (Cat. No. 3-7/7149); FINAL MANUAL. [nd] 12p. (NP-3425)

Technical description, operating instructions, and maintenance problems are given for the Philips β-γ radiation monitor, designed for qualitative checking of contamination on bench surfaces, floors, and clothing. The monitor operates from a nonself-quenching type G-M counter with a sensitive area of about 4.5×1.5 cms and includes the power supplies for the Geiger and counting circuits, and connections for a pair of headphones for aural indication of counting rate.

7190
Atomic Energy Research Establishment, Harwell, Berks (England)
GENERAL PURPOSE RATEMETER TYPE 1037A AND 1138A; INTERIM MANUAL. [nd] 38p. (NP-3438)

7191
Atomic Energy Research Establishment, Harwell, Berks (England)
GAMMA DOOR MONITOR TYPE 1025B (Cat. No. 3-7/5696); FINAL MANUAL. [nd] 38p. (NP-3439)

7192
Atomic Energy Research Establishment, Harwell, Berks (England)
ALPHA ASSAY EQUIPMENT TYPE 1077B; INTERIM MANUAL. [nd] 21p. (NP-3420)

7193
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR MONITOR RADIATION GAMMA TYPE 1006 (Cat. No. 3-7/3693). [nd] 36p. (NP-3418)

Operating and maintenance information is given for the γ radiation monitor type 1006. The instrument consists of five separate units interconnected by cables, and designed for permanent installation in places where staff workers are exposed to γ radiation. Indication is given of both the instantaneous level of radiation and the quantity of radiation received during a given period, the former on a specially calibrated meter and the latter by the displacement from zero of a clock hand which rotates at a rate depending on the radiation level.

7194
Atomic Energy Research Establishment, Harwell, Berks (England)
EFFLUENT MONITOR TYPE 1026 (Cat. No. 37/4152); INTERIM MANUAL. [nd] 11p. (NP-3419)

Operating and maintenance instructions are given for the equipment which consists of an immersion unit, a monitor type 1026, and a recording milliammeter. The monitor was

designed as a health instrument to detect radioactive contamination in effluent water. It is a low sensitivity type instrument designed to indicate the average radioactive level of the effluent and to give an audible warning when the level reaches approximately twice the normal background count.

7195
Atomic Energy Research Establishment, Harwell, Berks (England)
PORTABLE SLOW NEUTRON MONITOR TYPE 1116A (Cat. No. 3-7/6308) INTERIM MANUAL. [nd] 19p. (NP-3407)

Technical description, operating conditions, and maintenance problems are given in this interim manual. Monitor type 1116A is a portable battery-operated slow-neutron rate monitor intended for making surveys of radiation hazards. The monitor is an adapted version of type 1043C and is fitted with a BF_3 chamber. Range reception of the meter is 0 to 4000 and 0 to 40,000 slow neutrons/cm²/sec.

7196
Atomic Energy Research Establishment, Harwell, Berks (England)
VIBRATING REED ELECTROMETER TYPE 1079C, 1149B AND 1141A; INTERIM MANUAL. [nd] 26p. (NP-3410)

Technical description, operating conditions, and maintenance problems are discussed in this interim manual for an indicating unit type 1079C embodying the meter, power supplies, and an electrometer unit. The electrometer type 1079C is designed to measure currents between 10^{-8} and 5×10^{-15} amp and is intended mainly for the measurement of ionization currents in radiation monitoring equipment. Type 1149B is designed to be used with the TPA type ionization chamber. Type 1141A is a modified version of type 1079C produced for the measurement of currents from ionization chamber type 1083A in a particular installation.

7197
Atomic Energy Research Establishment, Harwell, Berks (England)
BETA COUNTING WITH ALPHA ASSAY EQUIPMENT TYPE 1077B; INTERIM MANUAL. [nd] 19p. (NP-3409)

A description is given of the units comprising a β proportional-counter installation. Detailed optimum operating conditions and typical performance figures are given. Experimental factors discussed are best gas to use, setting of time constant controls in the amplifier, desirable shape, and material for sample dish.

7198
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR MONITOR C.R.O. 1000 (Cat. No. 3-7/0004) AND PROBE UNIT 1000 (Cat. No. 3-7/0005). [nd] 33p. (NP-3422)

Operating and maintenance information is given for the monitor C.R.O. 1000, which is a cathode-ray oscilloscope with built-in power pack, time base, amplifier circuits, and probe unit 1000. The equipment has been designed to give a visual check on the operation of a linear amplifier system, displaying the output pulses on the cathode-ray tube, in addition to providing an indication of the pulse amplitude necessary to operate the discriminator circuit which follows the linear amplifier. The monitor is fitted with a probe cathode-follower unit which accepts the linear amplifier output signal with the minimum loading on the amplifier circuits.

7199
Atomic Energy Research Establishment, Harwell, Berks (England)
WORKING INSTRUCTION MANUAL FOR SCALER TYPE 1009A (Cat. No. 3-7/3747). [nd] 53p. (NP-3423)

Operating and maintenance information is given for the scaler type 1009A, designed to count random or regular electrical impulses (α, β, or γ rays) of amplitude greater than a predetermined value set between +5 and +50 v.

7200
A TECHNIC FOR MEASUREMENT OF RADIOACTIVE IODINE (I-131) UPTAKE BY THE HUMAN THYROID GLAND. John U. Hidalgo, Samuel B. Nadler, Ted Bloch, and Robert T. Nieset. Proc. Soc. Exptl. Biol. Med. 77, 764-6(1951) Aug.

It was determined that, with a bismuth cathode tube, the uptake of a 50-μc tracer dose of I^{131} by the human thyroid can be measured efficiently. The usefulness of this tube in γ counting is compared with that of the conventional mica end-window counter.

7201
MEASUREMENT OF FAST NEUTRON VELOCITIES BY DELAYED COINCIDENCE. D. B. James and P. B. Treacy. Proc. Phys. Soc. (London) 64A, 847-8(1951) Sept. (Letter to the editor)

A method for measuring fast-neutron velocities by delayed coincidence is described. Photomultipliers with liquid scintillators are used for detection of both neutron and γ rays. The multipliers are E.M.I.-type end-window 14-stage tubes, with gains about 10^9. The scintillators consist of terphenyl and are contained in glass flasks coated on the outside with Mg oxide. The γ detector is 1 liter in volume, and placed close to the target. The neutron detector is 5 liters in volume, and placed 5 m from the target. The delay spectrum for coincidences from the $Be^9(d,n\gamma)B^{10}$ reaction at 0.48 Mev bombarding energy was measured using this method.

7202
A NEW APPARATUS FOR THE STUDY OF NUCLEAR REACTIONS. M. Ader, J. Amoignon, J. Debiesse, T. Kahan, and J. Le Run. J. phys. radium 12, 762-3(1951) July-Aug.-Sept. (Letter to the editor; in French)

The simple device consists essentially of a stainless-steel ring, the interior of which is machined into numerous flats of a convenient size for mounting photographic emulsions. A collimated beam enters the apparatus and impinges on the axially-located scatterer. Simultaneous investigation of scattering through 360° is thus possible.

7203
RELATIVE SENSITIVITIES OF WINDOWLESS AND END-WINDOW COUNTERS. Walter L. Graf, C. L. Comar, and Ira B. Whitney. Nucleonics 9, No. 4, 22-7(1951) Oct.

The thin-mica end-window counter, the windowless G-M flow counter, and the windowless proportional counter were compared to obtain the relative sensitivities. Self-absorption in low-energy β emitters limits the sensitivity of the measurement. It was necessary in the comparison to include a consideration of the effect of the counter type upon the self-absorption characteristics. Absorption data are presented for C^{14}, S^{35}, and Ca^{45}. It was found too complicated to generalize the results of this study to give an over-all efficiency of each counter, but the information presented will enable the reader to apply this information to his own particular condition.

7204
ON THE DISPOSITION OF THE DIAPHRAGMS OF A HELICOIDAL BETA SPECTROMETER. Enrico Persico. Atti accad. nazl. Lincei Classe sci. fis. mat. e nat. 10, 344-8(1951) May.

Consideration is given to the placement of the exit diaphragm for maximum resolution. The dependence of the image on the position of the entrance diaphragm is studied, and on this basis calculations are made to give a rule for

the most practical position of the exit slit. A general formula is derived for the half angle of the cone on which must be placed the two edges of the exit slit. The general formula is then applied to the case of uniform field (solenoidal spectrometer). It is shown that the placement advocated by Frankel (Phys. Rev. 73, 804(1948)) and generally used is approximately correct only if the entrance diaphragm is very near the source. The formulas derived give a means of calculating the position of the input diaphragm which will allow the output slit to be horizontal.

7205

SCINTILLATIONS IN THE DIPHENYLPOLYENES AND RELATED COMPOUNDS. W. S. Koski and C. O. Thomas. J. Chem. Phys. 19, 1286-90(1951) Oct.

Scintillations in two series of structurally related organic compounds were investigated. One series was composed of the symmetrical diphenyl derivatives of ethane, ethylene, and acetylene. The other series consisted of the diphenylpolyenes from diphenyl to diphenyloctatetraene. In the first series it was found that the wavelength of the emission spectra ranged from 3550 to 4030 A and the counting efficiency increased with the number of π electrons in the system. In the second series the emission spectra wavelengths ranged from 3400 to 6000 A and increased as one went up the series, whereas the counting efficiency went through a maximum at diphenyl butadiene. The results were interpreted in terms of the "metallic" model for conjugated compounds.

7206

METHODS FOR MEASUREMENT OF AVERAGE VALUES OF ENERGY AND MOMENTUM OF β-RECOILS. O. Kofoed-Hansen. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 26, No. 8, 1-32(1951).

The requirements are explored for an instrument in which average values of the energy and momentum of recoil particles from monatomic gases can be determined. The method is based on a simple connection between these average values and the number of recoils collected on the plates of a plane parallel condenser filled with a radioactive inert gas at a low pressure. The average energy of the recoil particles can be measured for suitable electric potential differences between the plates. If instead one uses a magnetic field parallel to the plates the average momenta are obtained. There are significant differences between measuring the number of recoils striking the plates and the currents to the plates. In order to find the effectiveness of the instrument a number of possible deviations from the idealized instrument are treated. These include the finite size of the condenser, inhomogeneities of the field, the question of secondary electrons, and difficulties in the determination of the total number of disintegrations. The discussion shows that it is most favorable to compare measurements of currents performed first with a purely magnetic field and secondly with a combined electric and magnetic field. In this way it is possible to determine the difference between the average values of the recoil and β-particle momenta divided by the a average value of the momentum of the β particles. This ratio depends strongly on the angular correlation in the emission of the β-particle and the neutrino. Furthermore, this instrument enables one to find the average value of the recoil energy and the average value of the charge of the recoil ions. (auth)

7207

DESIGN OF DIRECTIONAL COUNTERS FOR CLINICAL USE. Brian D. Corbett and A. J. Honour. Nucleonics 9, No. 5, 43-53(1951) Nov.

The design of a small directional G-M counter for clinical work with I^{131} is discussed in detail. Response characteristics are diagramed, and a sectional drawing of one such counter, called the "Five-Pounder," is shown with all accessories. Many of the principles involved are applicable to the case of a scintillation instrument, and mention is made of modifications which would be desirable for directional detection of hard-γ emitters.

MESONS

7208

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF MAY 10, 1951; by Bonnie E. Cushman. Sept. 11, 1951. 7p. (UCRL-1304)

The π/μ mass ratio has been reevaluated, the proton being used as the comparison particle. The principle involved is as follows: the range is linearly dependent on the momentum and, if the range ratio of the two particles is equal to their momentum ratio, their velocities must be equal; therefore the ratio must also be the mass ratio. On this basis π = 276.1 ± 2.3 and μ = 209.6 ± 2.4 m_e. The law of grain density in nuclear emulsions has been studied in order to determine n (no. of grains per micron) and its relationship to ionization and rate of energy loss. Results to date indicate that n is a function of ionization only and when the grain density is small it is proportional to the energy loss. Furthermore, n approaches saturation as the rate of energy loss increases. The grain-density–energy-loss relationship is plotted.

7209

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF MAY 3, 1951; by Bonnie E. Cushman. Sept. 13, 1951. Decl. Oct. 26, 1951. 10p. (AECD-3265; UCRL-1303)

The decay scheme for Pa^{232} and Pa^{235} is presented along with the energy cycles of the 4n-type nuclei in their region. A positron spectrum was obtained from μ mesons. Eighty tracks of decay positrons with a distribution maximum at 35 Mev were observed; the largest energy found was 52.5 Mev. The yield of neutral mesons in proton bombardment of B and C was investigated by detecting their decay γ radiation. It had been found that the γ yield from O_2 was ⅛ that from D_2 and the effect was attributed to neutrons in the nucleus. Similar results are here obtained when Be^9 is compared with B^{10} and B^{11} with C^{12}. There is no explanation, as yet, why the yield is proportional to the number of neutrons as far as A = 16; this effect is not found with the heavy elements.

7210

Radiation Lab., Univ. of Calif.

THE YIELD OF NEUTRAL MESONS FROM PROTON BOMBARDMENT OF HYDROGEN AND DEUTERIUM (thesis); by Norman Knable. Aug. 15, 1951. 51p. (UCRL-1444)

Neutral mesons have been produced by bombarding various nuclei in the external 341-Mev proton beam of the Berkeley synchro-cyclotron. The yield from hydrogen has been compared with that from deuterium, obtained in a heavy water–ordinary water difference measurement, for the purpose of investigating a selection rule forbidding the production of neutral mesons from proton-proton collisions. A new type of photon detector, which discriminates against detection of the large neutron and proton background, was employed to detect the decay photons of neutral mesons. In performing the water–heavy water difference experiment it was noted that the yield of neutral mesons appeared to be determined only by the number of neutrons in the bombarded nucleus. This was verified in other nuclei up to O^{16}. By comparing the neutral-meson yields from polyethylene, carbon, H_2^2O, H_2^1O, and liquid oxygen, an upper limit on the ratios of the cross sections for the reactions which yield neutral mesons from proton-proton collisions and proton-deuteron collisions could be determined and was found in this case to be 0.08 ± 0.07. (auth)

7211
MESONS. W. O. Lock and H. Muirhead. Experientia 7, 321-36(1951) Sept.

A summary of present knowledge concerning mesons is presented. The history of the meson problem and discoveries in the field are reviewed. 83 references. 12 figures.

7212
ON THE NUCLEAR SCATTERING OF NEGATIVE Pi-MESONS. G. Bernardini, E. T. Booth, and L. Lederman. Phys. Rev. 83, 1277-9(1951) Sept. 15. (Letter to the editor)

The analysis of the interactions of artificially produced π mesons of well-known energy has yielded direct evidence of the anticipated nuclear scattering. Combined plural-scattering and grain-density measurements were made upon tracks of incident and scattered particles in Ilford G5 plates. Some peculiar features of meson-nuclear phenomena are the relatively high probability for very-large-angle scatterings, the existence of inelastic scatterings with exceedingly large energy losses, and the dependence of these peculiar scatterings on the incident meson's energy. The frequency and angular distribution of all measured scatterings at various incident energies are given. A photomicrograph and momentum diagram are shown for one event which is especially difficult to reconcile with a single π-nucleon encounter. It seems likely that in complex nuclei the scattering as well as the absorption is a many-body process.

7213
NEUTRAL PHOTOMESON PRODUCTION AND NUCLEON ISOBARS. Keith A. Brueckner and K. M. Case. Phys. Rev. 83, 1141-7(1951) Sept. 15.

The magnitude of the neutral photomeson cross section, which is comparable with the cross section for charged mesons, is not given correctly by weak coupling perturbation theory. In fact, the phenomenon appears to depend on a nonlinear behavior of the meson fields corresponding to intermediate or strong coupling. Accordingly, the effect of the existence of nucleon isobars, which is one of the most characteristic features of strong coupling theory, has been investigated through the use of a classical model and is found to give the general features and magnitude of the neutral cross section correctly. The isobars are predicted to be unstable with an excitation energy of 300 to 400 Mev. (auth)

7214
NUCLEAR INTERACTION OF μ MESONS UNDERGROUND. Satio Hayakawa. Phys. Rev. 84, 37-43(1951) Oct. 1.

The nuclear interactions of μ mesons and the genetic relations among their secondary particles are analyzed on the basis of the data obtained with photographic plates exposed underground. The results are used to analyze neutron showers produced in an absorber at different depths of water. The contributions to the neutron showers from various components are compared. It is shown that the μ mesons directly producing neutron showers in the absorber and the nucleons produced by the μ mesons in the water above the apparatus and interacting in the absorber give the main contribution to the large neutron showers observed. The multiplicity spectrum of the neutrons is calculated by making use of a simplified model of the nucleon cascade and is shown to depend upon the selection bias of the detecting apparatus. The experimental results are consistently accounted for by assuming for the μ mesons a nuclear interaction cross section of ~10 μb per nucleon. The experiments at great depths suggest the predominance of small momentum transfers by nuclear collisions. The large cross section and the small momentum transfer can be described in terms of the virtual photons associated with μ mesons. These virtual photons produce in nuclear collisions real or virtual π mesons which can either escape or be absorbed in the nucleus. (auth)

7215
ANTICOMMUTATIVE MATRICES OF MESON THEORY. A. Borgardt. Doklady Akad. Nauk S.S.S.R. 78, No. 6, 1113-14(1951) June 21. (In Russian)

7216
SHORT μ-MESON TRACKS FROM π-MESON DECAYS. W. F. Fry. Phys. Rev. 83, 1268(1951) Sept. 15. (Letter to the editor)

A group of Ilford C2 200-μ plates was exposed in a spiral-orbit spectrometer to the Berkeley cyclotron. The plates were arranged in such a manner that π mesons of opposite signs entered the emulsions from opposite directions. A total of 3018 π-μ decays have been studied where both the π- and μ-meson tracks stopped in the emulsion. Four cases were found where the μ-meson tracks are unusually short, from 120 to 260 μ. Photomicrographs of two of these events are shown. In at least two cases the short ranges of the μ mesons are apparently not due to decay in flight of the π mesons. In all of the 26 cases where the μ-meson tracks are shorter than 520 μ, the π mesons entered the emulsions from such a direction as to indicate that the π mesons were positively charged.

7217
POLARIZATION OF VECTOR MESONS PRODUCED IN NUCLEON-NUCLEON COLLISIONS. Lee C. Teng. Phys. Rev. 84, 308-14(1951) Oct. 15.

The polarization of vector mesons produced in free nucleon-nucleon collisions near the threshold is studied. The calculation is made under the Born approximation, assuming a phenomenological nuclear potential obtained from n – p scattering data for the interaction between nucleons. The vector meson produced is shown to be completely polarized (to the order of m/M) parallel to the direction of motion of the incoming nucleon for vector coupling between meson and nucleon, and perpendicular to this direction for tensor coupling. In particular, the same effect is shown to exist for the reactions $p+p \rightarrow p+n+\pi^+$ and $n+n \rightarrow p+n+\pi^-$ when the final proton and neutron fall into ^3s or ^1s deuteron states. The angular distribution of the out-going nucleons in the baricentric system for the inverse reactions can be employed as a means for detecting the polarization of the mesons. Cross sections for these reactions are also estimated. (auth)

MOLECULAR PROPERTIES

7218
Research Lab. of Electronics, Mass. Inst. of Tech.
ROTATIONAL MAGNETIC MOMENTS OF $^1\Sigma$ MOLECULES (Technical Report No. 184); by J. R. Eshbach and M. W. P. Strandberg. Jan. 9, 1951. 22p. (NP-3403)

The theory of the magnetic moment generated by the free rotation of a molecule with $^1\Sigma$ electronic ground states, i.e., zero total-orbital and zero total-spin angular momenta, and the interaction of this moment with an external magnetic field, the Zeeman effect, is presented. Nuclear and electronic contributions; vibrational, centrifugal, and isotopic effects; and the relation of rotational moments to magnetic susceptibilities are considered. Microwave measurements, details of which are to be described in a forthcoming report, of the Zeeman effect for a linear rotor, OCS, and a symmetric top, NH_3, are explained by this theory.

7219
Massachusetts Inst. of Tech.
QUARTERLY PROGRESS REPORT NO. 2; SOLID-STATE AND MOLECULAR THEORY GROUP. Oct. 15, 1951. 33p. (NP-3457)

Mathematical discussions of the following subjects are presented: determinantal wave functions and magnetic problems; determination of atomic wave functions; crystalline electric fields; energy bands in solids; superlattice

stability; theory of molecular oxygen; Heisenberg's model of ferromagnetism; crystal polarizabilities of various ions; the effects of configuration interaction on the hyperfine structure; and opacity of a compressed hydrogen gas.

NEUTRONS

7220

THE ANGULAR DISTRIBUTION OF NEUTRONS FROM THE (d,n) REACTION IN LIGHT ELEMENTS. J. Hughes. Proc. Phys. Soc. (London) 64A, 797-801(1951) Sept.

A proton recoil chamber with a thick polythene layer was used to determine the angular distribution of the neutrons from thick targets of Li, Be, B, C, O, Na, Mg, Al, Si, and S bombarded with 8-Mev deuterons. In all cases a pronounced forward maximum in intensity was found, the half width of the distribution decreasing with increasing atomic number. The absolute intensity of neutrons in the forward direction decreases as the atomic number increases but the dependence on atomic number is not a smooth function. The presence of forward peaks adds weight to the suggestion that even at low energies the major part of the (d,n) cross section can be attributed to a stripping process.

NUCLEAR PHYSICS

7221

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF MAY 17, 1951; by Bonnie E. Cushman. Sept. 11, 1951. 5p. (UCRL-1342)

The (d,p) and (d,n) reactions on Bi were studied as a means of determining how much energy a particle can possess and still remain in the nucleus. The cross-section curves for the two reactions are shown as a function of deuteron energy. The γ rays produced in the same nucleus in which π^- particles were formed were examined. The γ spectrum was measured with a pair spectrometer at various angles and energies, but no matter how the averaging was done the mean γ curve was unsymmetrical, indicating that the effect is not one of pure π^0 decay.

7222

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

PROGRESS REPORT; OCTOBER 1, 1950. 71p. (NP-3434)

7223

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

COSMIC RAY, ELEMENTARY PARTICLE SCATTERING, AND 12-MEV GENERATOR CONSTRUCTION AND HIGH VOLTAGE RESEARCH GROUPS, p.6-17 of PROGRESS REPORT; JANUARY 1, 1951. 12p. (NP-3437(p.6-17))

In cloud-chamber experiments on nuclear interactions some events were observed which are inconsistent with the $\pi \rightarrow \mu$ or $\mu \rightarrow e$ decay processes. A photograph is shown of one event which is consistent with the decay of a particle of mass ~900 m_e into a π meson. The reports of the Cosmic Ray and Elementary Particle Scattering Groups are almost entirely concerned with preparations for future experiments.

Measurements have been made on the emission of electrons by materials bombarded by high-energy electrons in the range 1.0 to 2.0 Mev. The secondary electron emission is less than 0.1 for graphite and increases progressively with atomic number to 0.4 for Au. A large proportion of the secondary electrons are of high energy, being the result of elastic nuclear scattering. The secondary electron emission from Au, stainless steel, Al, and C is plotted vs. primary energy of electrons and vs. collector potential. In building 28 the observation that even large protein molecules can withstand high cathode-ray doses if irradiated at low temperature has been further confirmed. Preliminary evidence indicates that low-temperature irradiation does not require increased doses to destroy bacteria but does increase the dose required for the inactivation of viruses.

7224

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF JULY 19, 1951; by Bonnie E. Cushman. Sept. 12, 1951. 4p. (UCRL-1457)

The final results of experiments on the production of mesons from He (UCRL-1317) are stated briefly. The mesons were collimated by a U collimating system and detected by C2 200-μ emulsions and stilbene crystals. π^-/π^+ ratios were obtained at 3 different angles with an over-all value of 0.97 ± 0.08. The results indicate that meson production is independent of angles and energy. Isotopes of Ra, Fr, and Rn produced by the spallation of Th irradiated in the 184-in. cyclotron have been studied with an α counter and spectrometer. The new Rn^{209} with only 123 neutrons has a half life of 33 min and an α time of ~10 hr.

7225

PRINCIPAL CONSIDERATIONS IN THE PERIODIC SYSTEM OF THE ELEMENTS. NUCLEAR PHYSICS CONSIDERATIONS. I. Richard Lepsius. Z. Physik 130, No. 3, 403-8(1951). (In German)

"Magic numbers" are arrived at by means of a binomial expansion.

7226

SHELLS IN HEAVY NUCLEI AND BINDING ENERGY OF NUCLEONS. V. A. Kravtsov. Doklady Akad. Nauk S.S.S.R. 78, No. 1, 43-6(1951) May 1. (In Russian)

A general discussion of the nucleon shells in nuclei of $Z > 80$, $N > 120$ is presented, based on data in the literature. 14 references.

7227

SHELLS IN LIGHT NUCLEI AND BINDING ENERGY OF NUCLEONS. V. A. Kravtsov. Doklady Akad. Nauk. S.S.S.R. 78, No. 2, 239-42(1951) May 11. (In Russian)

A general discussion of the nucleon shells in nuclei of $Z < 20$, $N < 20$ is presented, based on data in the literature. 6 references.

7228

THE VELOCITY OF GAMMA-RAYS IN AIR. M. R. Cleland and P. S. Jastram. Phys. Rev. 84, 271-3(1951) Oct. 15.

The velocity of 0.5-Mev gamma rays resulting from positron annihilation has been measured by means of scintillation counters and delayed-coincidence techniques. The value obtained is $(2.983 \pm 0.015) \times 10^{10}$ cm/sec. (auth)

NUCLEAR PROPERTIES

7229

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF JUNE 21, 1951; by Bonnie E. Cushman. Sept. 11, 1951. 6p. (UCRL-1370)

A search for the doubly charged particle of unit mass was made. A carbon target was bombarded by 350-Mev protons, and plates were placed under the circulating beam in such a way that doubly charged particles would strike them after a magnetic deflection of 180°. About 20 tracks were found with approximately the correct range and grain density to indicate the existence of He^1. Grain density and scattering of the suspected He^1 tracks were measured. After repeated counts it was concluded that the tracks were due to stray alpha particles and that there was no indication from this experiment that doubly charged nucleons exist.

7230
Rutgers Univ.
NUCLEAR AND ELECTRONIC PARAMAGNETISM AND LOW TEMPERATURE STUDIES: FIFTH ANNUAL PROGRESS REPORT; by F. G. Dunnington. Sept. 1, 1951. 55p. (NP-3398)

The pulse method in the measurement of relaxation parameters in nuclear magnetic resonance was tested in comparison with the more conventional modulation method and was found reliable. T_1 and T_2 for protons in glycerine are plotted by the two methods. A study of the "cyclotron effect" yielded a value of 5×10^{-5} gauss for the line width in water. In the study of the nuclear resonance of the protons in hydrogenated Pd, line widths and shift data were compared in the usual sponge sample and in spherical grains. Relaxation time, line width, and the height of the barrier against molecular rotation were studied in methane in the vicinity of the melting point and the λ-point. A method and apparatus are described for recording resonance absorption spectra of paramagnetic salts on the chart of a recording potentiometer. The method consists essentially of the measurement of the reflection coefficient of a resonant cavity containing the paramagnetic salt as a function of the d-c magnetic field in which the cavity is placed. Recorder traces are shown for diphenyl trinitrophenylhydrazyl and iron ammonium alum. In a study of the superconductivity of isotopes, critical field-temperature relations were obtained for Hg down to 1.37°K and for Sn down to 1.27°K. The magnetic susceptibility of single-crystal Sn rods at fields up to 12 gauss was measured in liquid He, and transitions from the superconducting state to normal are plotted.

7231
ON THE SPIN AND QUADRUPOLE MOMENT OF Cl^{36}. C. M. Johnson and Walter Gordy. Phys. Rev. 83, 1249 (1951) Sept. 15. (Letter to the editor)

The assignment of 2 for the nuclear spin of Cl^{36} has been confirmed by observation of the hyperfine structure of the $J = 0 \rightarrow 1$ transition of CH_3Cl^{36}. The quadrupole moment was found to be $-0.0168 \pm 0.0001 \times 10^{-24}$ cm^2. A cathode-ray oscilloscope picture of the spectrum is shown. Since the hyperfine-structure lines of an excited vibrational state of CH_3Cl^{35} occur near the Cl^{36} group, the frequencies of these lines were also measured to determine whether or not the quadrupole coupling remained the same as in the ground state. The coupling was found to be −74.70 Mc/sec, which is not significantly different from the latest value −74.77 Mc/sec, given for the ground state (Geschwind et al., Phys. Rev. 81, 288(1951)).

7232
ISOTOPE SHIFT IN THE SPECTRUM OF Os I AND THE MAGNETIC MOMENT OF Os^{189}. S. Suwa. Phys. Rev. 83, 1258-9(1951) Sept. 15. (Letter to the editor)

A water-cooled hollow-cathode discharge tube and a Fabry-Perot etalon have been used in an investigation of the hyperfine structure of Os I. The hfs of any clearly resolved line was found to consist of six components. Four of them are due to the even isotopes (186, 188, 190, 192), and the remaining two are due to the odd isotope 189. The ratios of the displacement in wave number $\Delta\nu$(186-188): $\Delta\nu$(190-192) were found to be nearly constant (for all lines except λ 4135) and equal to $1.1_9 : 1.05 : 1$. The nuclear spin of Os^{189} is probably ½, and its magnetic moment calculated from the hfs of λ 4420 and λ 4261 is +0.6 ± 0.1 nuclear magnetons.

7233
RADIATIVE TRANSITION PROBABILITIES IN NUCLEI. V. F. Weisskopf. Phys. Rev. 83, 1073(1951) Sept. 1 (Letter to the editor)

An exact expression is given for the transition probability per unit time in a transition from nuclear state a to nuclear state b with emission of a quantum of multipole radiation of angular momentum l (2^l-pole) and z component m. Then rough approximations for the matrix elements involved are given. The approximations are based upon an extreme application of the independent-particle model of the nucleus, and it was assumed that a proton is responsible for the transition.

7234
THE SYSTEMATICS OF NUCLEAR ENERGIES. Alex E. S. Green. Phys. Rev. 83, 1248-9(1951) Sept. 15. (Letter to the editor)

The Weizsäcker semiempirical formula for nuclear energies may, by straightforward analysis, be placed in the form, $E(A,D) = A\epsilon_v(A) + J(A)[D - D_v(A)]^2 + H(A)\delta$ where $D = N-Z$ and δ is ±1 or 0 according to the nuclear type. The complicated key functions $A\epsilon_v(A)$, $J(A)$, $H(A)$, $D_v(A)$ are replaced by simple analytical functions whose constants have been calculated and are given. The Q value of a nuclear reaction is also written in a more convenient form. These simple key functions characterize an empirical energy surface which does not deviate significantly from the Weizsäcker surface for the great range of mass numbers and which lies significantly closer to the true nuclear surface for very heavy nuclei.

7235
THE SPINS AND PARITIES OF THE 3.7- 3.9-MEV DOUBLET IN C^{13}. J. Rotblat. Phys. Rev. 83, 1271-2(1951) Sept. 15. (Letter to the editor)

The existence of two levels in C^{13} at 3.683 and 3.884 Mev has been established. An 8-Mev deuteron beam was used, and the protons were recorded by a photographic-emulsion technique. The protons of longer range have a much lower intensity than those of the shorter range; at some angles the intensity of the former is only 2% of that of the latter. The angular distributions of the two groups of protons have also been investigated and the observed angular distributions up to angles of about 90° are plotted. The 3.7-Mev state of C^{13} has a spin of ½ or ³⁄₂ and odd parity, while the 3.9-Mev state has spin ³⁄₂ or ⁵⁄₂ and even parity.

7236
ON THE MAGNETIC MOMENTS OF ODD-ODD NUCLEI. Igal Talmi. Phys. Rev. 83, 1248(1951) Sept. 15. (Letter to the editor)

It was pointed out by Feenberg (Phys. Rev. 76, 1275 (1949)) and others that the magnetic moments of odd-odd nuclei are very close to the values calculated with the assumption that the two odd nucleons move in a central field and their angular momenta combine in the j-j coupling scheme. This excellent agreement is rather astonishing in view of the large deviations of the magnetic moments of odd-even nuclei from the Schmidt values (also in the case of light nuclei). The aim of this note is to point out that the apparent contradiction between these two facts disappears upon consideration of the mutual compensation of the changes in the magnetic moment due to the odd proton and odd neutron. Calculated and observed magnetic moments of Li^6, B^{10}, N^{14}, Na^{22}, and K^{40} are tabulated. In all the cases where the proton and neutron configurations are the same, the calculated and experimental values agree within a few per cent. The only case where the proton and neutron are in different orbits is K^{40}; only in this case is the deviation not small. The expected deviation in such cases can be calculated easily.

7237
SOME NEW VALUES OF ATOMIC MASSES, PRINCIPALLY IN THE REGION OF 82 NEUTRONS. Henry E. Duckworth,

Cort L. Kegley, John M. Olson, and George S. Stanford. Phys. Rev. 83, 1114-17(1951) Sept. 15.

Some new mass comparisons are described which lead to atomic mass values for 29 stable nuclides. There is shown to be a definite mass effect associated with the closing of the 82-neutron shell and probably also with the closing of the 58-proton shell. There is evidence that the minimum of the packing fraction curve occurs at $_{28}Ni^{62}$. Recent microwave data are used to obtain the masses of Ge^{74} and Ge^{76} from the mass spectrographically determined masses of Ge^{70} and Ge^{72}. (auth)

7238

THE QUADRUPOLE RESONANCE SPECTRUM IN CRYSTALLINE ANTIMONY TRICHLORIDE AND THE RATIO OF THE ANTIMONY NUCLEAR QUADRUPOLE MOMENTS. H. G. Dehmelt and H. Kruger. Z. Physik 130, No. 3, 385-91 (1951). (In German)

Nine magnetic absorption lines have been found in polycrystalline $SbCl_3$ between 15×10^6 and 120×10^6 sec^{-1} and assigned to the nuclear quadrupole resonance frequencies of Sb^{121}, S^{123}, Cl^{35}, and Cl^{37}. From these frequencies the following ratios of electric nuclear quadrupole moments were calculated: $Q(Sb^{123})/Q(Sb^{121}) = 1.2751 \pm 0.0002$; $Q(Cl^{35})/Q(Cl^{37}) = 1.2689 \pm 0.0002$.

7239

THE NEW STATE IN Li^7 AT LOW BOMBARDING ENERGY. R. W. Gelinas, C. M. Class, and S. S. Hanna. Phys. Rev. 83, 1260-1(1951) Sept. 15. (Letter to the editor)

A search has been made for the state in Li^7 at 4.77 ± 0.10 Mev reported by Gove and Harvey (Phys. Rev. 82, 299, 658 (1951)). Be was bombarded with deuterons at an energy near 0.5 Mev, and the α spectrum was examined at 90° by magnetic analysis. The magnetic spectra of $Be^9 \pm d$ in the neighborhood of the expected 4.7-Mev state, obtained with targets of 3000 and 1000 A thickness, respectively, are shown. A group of particles on the low-energy side of the Li recoils is well resolved and falls in the right region to be identified with the α group observed by Gove and Harvey. A Q of 2.53 ± 0.02 Mev and an excitation energy in Li^7 of 4.62 ± 0.02 Mev were calculated. The intensity of the transition is estimated to be about 25% that of the ground-state α transition at this bombarding energy.

7240

EVIDENCE REGARDING INSTABILITY OF H^4. G. Breit and J. S. McIntosh. Phys. Rev. 83, 1245(1951) Sept. 15. (Letter to the editor)

Possible states of H^4 are tabulated, together with the type of transition and expected half life for each. Allowed and excluded regions for each possible state are shown on a graph. The most likely possibility of a stable state is made improbable by the experiments of McNeill and Rall (Phys. Rev. 82, 1244-5(1951)).

7241

BAND SPECTRA OF THE SELENIUM ISOTOPES. Sumner P. Davis and F. A. Jenkins. Phys. Rev. 83, 1269(1951) Sept. 15. (Letter to the editor)

An investigation of the rotation structure of the $^1\Sigma_u^+ - {}^1\Sigma_g^+$ band system of Se_2 in the region 3700 to 3815 A has been undertaken. Alternating intensities in the rotational lines of the electronic band spectrum were observed. Spectrograms were obtained of the separated isotopes in which the major components were Se^{77}, Se^{78}, and Se^{80}. It is concluded that the spin of Se^{78} is zero and that of Se^{77} is ½. The odd neutron in Se^{77} is in the $p_{½}$ state.

7242

Z-DEPENDENCE OF THE CROSS SECTION FOR PHOTOCAPTURE BY NUCLEI. J. Heidmann and H. A. Bethe. Phys. Rev. 84, 274-81(1951) Oct. 15.

The number of neutrons evaporated by nuclei excited by Li(p,γ) photons is calculated along the compound nucleus formalism. It is found, for light nuclei, to be very small and to exhibit an odd-even alternation. From experimental cross sections for photoneutron production at 17 Mev, the cross section for photocapture by nuclei is deduced, and is found to be proportional to Z within 25%. Material is presented for the application of the compound nucleus formalism to light nuclei, in particular a formula for the density of levels. (auth)

7243

ON A PHENOMENOLOGICAL NEUTRON-PROTON INTERACTION. Herman Feshbach. Phys. Rev. 84, 194-203(1951) Oct. 15.

This paper describes the calculations and results obtained in fitting a phenomenological interaction to the properties of the deuteron and related low-energy phenomena. This interaction is a linear combination of a central and tensor potential, where both potentials are of the Yukawa shape, but with different ranges. The calculations were based on the variation-iteration method. The nonpositive definite character of the tensor potential complicates the nature of the convergence to the correct eigenvalue. Special methods are described to overcome this difficulty. The results are presented in tabular form as values of the well depth parameter and of the quadrupole moment for four central potential ranges, five tensor ranges, and three values of the tensor strength. These tables also include values of the fractional amount of D state and of the effective triplet range. The photoelectric cross section of the deuteron is shown to involve only the triplet effective range in addition to the familiar zero-range formula. The cross section for photomagnetic capture contains the singlet and triplet phenomenological parameters and, in addition, a mixed effective range which also includes the effect of an exchange magnetic moment. The value of the mixed range, as inferred from the experimental capture cross section, agrees with the average of the singlet and triplet effective ranges, within the rather large experimental uncertainties. For the energy domain in which it is appreciable, the photomagnetic cross section is almost uniquely fixed by the capture cross section. The comparison of these cross sections with experiment is satisfactory.

7244

A STEADY-STATE TRANSIENT TECHNIQUE IN NUCLEAR INDUCTION. R. Bradford, C. Clay, and E. Strick. Phys. Rev. 84, 157-8(1951) Oct. 1. (Letter to the editor)

A new nuclear-resonance transient phenomenon has been observed during the time between radiofrequency pulses when this time is of the order of the nuclear relaxation time, T_2. The new transient consists of the expected "free" decay following removal of the r-f field, plus an attenuated mirror image of this decay, inverted in sign and running backward in time from the onset of the next pulse. This phenomenon occurs as a result of the establishment of a "steady-state" transient in the presence of magnetic-field inhomogeneities. A typical photograph of the complete phenomenon is shown. Uehling's (private communication) solution of the Bloch equations gives an expression for the transient between pulses in the rotating coordinate system before introduction of field inhomogeneities, and it is indicated how these equations can be used to determine the magnet homogeneity and T_2, especially when $T_2 > 10^{-3}$ sec.

7245

TOTAL CROSS SECTIONS OF LIGHT NUCLEI FOR p,T-NEUTRONS. C. K. Bockelman, D. W. Miller, R. K. Adair, and H. H. Barschall. Phys. Rev. 84, 69-75(1951) Oct. 1.

An abstract of this paper was issued as report AECU-1417 and appears in its entirety in Nuclear Science Abstracts as NSA 5-5368.

7246

RESONANCE IN THE NEUTRON CROSS SECTION OF LITHIUM. P. H. Stelson and W. M. Preston. Phys. Rev. 84, 162-3(1951) Oct. 1. (Letter to the editor)

The total neutron cross section of Li has been measured using neutrons from the Li(p,n) reaction. The large resonance at 270 kev reported by Adair (Phys. Rev. 79, 1018(1950)) is interpreted as an excited state in Li^8 with total angular momentum J = 3 (instead of J = 2 as suggested by Adair) formed by l = 1 neutrons. $\sigma_{max} - \sigma_{potential} = 10.0$ barns.

NUCLEAR REACTORS

7247

Westinghouse Atomic Power Div.

PILE TRANSFER FUNCTIONS; by Joseph P. Franz. July 18, 1949. Decl. Oct. 26, 1951. 10p. (AECD-3260; Memo APIC-4 SM-1)

A detailed derivation is presented of the transfer function of a critical pile (actually of an electronic pile simulator), the purpose being to relate the steady-state description and the transient response to a step-function change of reactivity. The transfer function of a critical pile is determined from the differential equations of the pile. The response of a steady-state pile to a step-function change of reactivity is expressed as a sum of exponential terms to which the Laplace transformation is applied with the result that the solutions are equal but negative to the solutions of a steady-state fifth-degree equation.

7248

INSTRUMENTATION AND CONTROL OF REACTORS. J. D. Trimmer and W. H. Jordan. Nucleonics 9, No. 4, 60-8(1951) Oct.

Of the many factors affecting reactor control, the most important — reactor kinetics, space relation of control rods, load and temperature effects — are discussed in this summary. In the discussion of reactor kinetics attention is directed to the coefficient A(t) as the vehicle of control of the set of differential equation $(dn/dt) = A(t)n + \sum_{i=1}^{6} \lambda_i C_i + S(t)$. This quantity A(t) depends more or less on everything in and around the reactor; thus the control-rod space dependence and the reactor load are also a function of the coefficient A(t). The effect of the load on the reactor is similar to that of control rods, in that it involves the coefficient A(t), but differs in being thermal in action. Temperature changes in a reactor affect its reactivity in two principal ways which may be identified as nuclear temperature effects and density temperature effects. Instruments and mathematical problems are cited.

7249

HEAVY-WATER REACTOR AT KJELLER, NORWAY. Odd Dahl and Gunnar Randers. Nucleonics 9, No. 5, 5-17(1951) Nov.

Detailed information about the components of the 100-kev nuclear reactor (nicknamed Jeep) put into operation in Aug. by the joint Norwegian-Netherlands atomic energy project is given. Twelve photographs are included.

7250

USES AND LIMITATIONS OF A LOW-POWER NUCLEAR REACTOR. Clifford K. Beck. Nucleonics 9, No. 5, 18-27 (1951) Nov.

Characteristics of reactors operating below ~100 kev are described in general. The use of such a reactor as a source of fission products, neutrons and other radiations for research, and activated isotopes, and as a device of intrinsic interest are discussed in a semipopular way. 58 references.

NUCLEAR TRANSFORMATION

7251

Los Alamos Scientific Lab.

VELOCITIES OF FRAGMENTS FROM FISSION OF U^{233}, U^{235}, AND Pu^{239}; by R. B. Leachman. [nd] Decl. Oct. 26, 1951. 13p. (AECD-3267; LADC-1058)

The velocity distributions of fragments from the slow neutron fission of U^{233}, U^{235}, and Pu^{239} have been measured by a time-of-flight method. When compared with ionization chamber data, the average of these data indicate that in A the energy-ionization ratios for the most probable light and heavy fragments exceed that of α particles by 6 and 11%, respectively. The resulting corrections, such as a 12.4 Mev increase in ionization chamber value of the total kinetic energy of the fragment, bring the ionization chamber data into better agreement with other data on fission fragments. (auth)

7252

Radiation Lab., Univ. of Calif.

$C^{12}(p,pn)C^{11}$ CROSS SECTION FROM THRESHOLD TO 340 MEV; by R. Lee Aamodt, Vincent Peterson, and Robert Phillips. Sept. 14, 1951. 34p. (UCRL-1400)

The excitation function for the reaction $C^{12}(p,pn)C^{11}$ has been measured from threshold (18.5 ± 0.3 Mev) to 340 Mev. The excitation curve from threshold to 32 Mev was obtained with the 40-ft linear accelerator and a stacked-foil technique. For 340-Mev protons from the 184-in. cyclotron absolute measurements of the cross section were made at various energies from 340 to 93 Mev by bombarding a polystyrene foil directly in front of the Faraday cup used to measure the proton current. The foils were counted on the lower shelves of an end-window Geiger counter and their counting rates compared with those of a standard β source. Data obtained with magnetically focused 110-Mev protons in the Harvard cyclotron are included for the region 32 to 100 Mev. The cross section has a broad maximum of 100 mb near 45 Mev and decreases to 43 mb at 340 Mev.

7253

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

RADIOACTIVITY AND CYCLOTRON GROUP, p.43-57 of PROGRESS REPORT; JANUARY 1, 1951. 15p. (NP-3437 (p.43-57))

The results of β-γ angular correlation experiments on Sb^{124} and Rb^{86} are presented graphically. A β-γ correlation of about +0.13 has been found for 460-kev β rays in the decay of I^{126}. A true triple-coincidence rate of the expected order of magnitude was observed, with a specially designed apparatus, in the decay of Cs^{134}. A search was made for triple coincidences in the decay of Rh^{106} but none were found. The reactions $Li^7(p,p')Li^{7*}$ and $Li^7(\alpha,\alpha')Li^{7*}$ have been investigated and are discussed at some length. The average excitation energy for the new level in Li^7 from these reactions and the previously studied reactions $Be^9(d,\alpha)Li^{7*}$ and $Li^7(d,d')Li^{7*}$ is 4.77 ± 0.10 Mev. The angular distribution of protons from the $Al^{27}(d,p)Al^{28}$ reaction (Q = 5.50 Mev) for a number of incident deuteron energies is plotted. The angular distribution of the ground-state deuteron group from the $Be^9(p,d)Be^8$ reaction is shown. The absolute differential cross section has been measured at 100° and is ~2 mb. The differential cross section was integrated over angle, and a total cross section for the ground-state deuteron peak of 50 mb was obtained. Relative cross sections for elastic scattering of protons and α particles from Li^7 are plotted. Proportional-counter studies with argon-methane and argon-propane mixtures are reported.

7254

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

NUCLEAR CROSS SECTIONS GROUP, p.34-42 of PROGRESS REPORT; JANUARY 1, 1951. 9p. (NP-3437(p.34-42))

A sharp proton group has been found from a target of SiO_2 evaporated onto Pt sheet. It is ascribed to the reaction $D^2(d,p)T^3$ from the deuterium deposited on the target exposed to the beam. The Q values obtained for three bom-

barding energies agree to within ±3 kev, the average being 4.030 ± 0.006 Mev. A triton group has been observed from four different C targets, apparently from the reaction $C^{13}(d,t)C^{12}$. A Q value of 1.310 ± 0.006 Mev was calculated for the reaction. The excited states of F^{20} have been investigated using the $F^{19}(d,p)F^{20}$ reaction with incident deuteron energies of 1.5 and 1.8 Mev. Proton groups corresponding to the following Q values were observed: 4.37, 3.72, 3.55, 3.39, 3.32, 3.06, 2.40, and 2.33 Mev. These correspond to excitation energies of 0, 0.65, 0.82, 0.98, 1.05, 1.31, 1.97, and 2.04 Mev. The Q values obtained for the reaction $Na^{23}(d,p)Na^{24}$ are 4.73, 4.26, 4.17, 3.39, 2.89, 2.86, 2.17, and 1.32 Mev. The $Al^{27}(d,p)Al^{28}$ reaction has been studied, and the level in Al^{28} at 30 kev above the ground state has been further confirmed. An investigation has been made at 1.81-Mev bombarding energy of the $Si^{30}(d,p)Si^{31}$ reaction using the 180° magnetic spectrometer to analyze the proton groups. The results of an incomplete survey indicate four proton groups which are much more intense from an enriched Si^{30} target. These groups can be definitely assigend to the $Si^{30}(d,p)Si^{31}$ reaction and have measured Q values of 4.367, 3.604, 2.666, and −0.021 Mev, corresponding to the ground state of Si^{31} and excited states at 0.763, 1.701, and 4.388 Mev (accurate to ±10 kev). A complete list of the final Q values of reaction energies of 38 ground-state transitions induced by proton and deuteron bombardment of light nuclei from D_2 through S is given. The mass of He^4 has been calculated from two series of reactions, and a weighted average gives 4.003865 ± 0.000007 amu.

7255

Radiation Lab., Univ. of Calif.

CARRIER FREE RADIOISOTOPES FROM CYCLOTRON TARGETS; XXIV. PREPARATION AND ISOLATION OF $Ir^{188,190,192}$ FROM OSMIUM; by Herman R. Haymond, Warren M. Garrison, and Joseph G. Hamilton. Sept. 26, 1951. 3p. (UCRL-1486)

A method for the isolation of Ir activities from ir-radiated Os without the addition of stable Ir carrier is described. Bombardment of Os with 19-Mev deuterons produced, by (d,2n) and (d,n) reactions, several long-lived, known, radioactive isotopes of Ir; viz., Ir^{187}, Ir^{188}, two isomers of Ir^{190}, and Ir^{192}. The decay periods of the isolated activity agreed with published data.

7256

MULTIPLE NEUTRON CAPTURE PROCESSES. R. F. Van Wye and J. C. Beckerley. Nucleonics 9, No. 4, 17-21 (1951) Oct.

In conversion reactors for the production of fissionable material and in breeders, neutron economy is vital. A general formalism is presented for evaluating effects of neutron capture by the initial nucleus and its products. The transformation processes must be represented by a network sequence rather than a linear one. Diagrams are presented to show the probable network sequence. The quantities of the isotopes Th^{233}, Th^{234}, Pu^{233}, and Pu^{234} when Th is bombarded by thermal neutrons are tabulated.

7257

THE PHOTODISINTEGRATION CROSS SECTION OF THE DEUTERON. Stirling A. Colgate. Phys. Rev. 83, 1262-3 (1951) Sept. 15. (Letter to the editor)

The photodisintegration cross section of deuterium by γ rays of ThC'' (Tl^{208}) has been observed by measuring the difference between the total γ-ray absorption cross sections in D_2O and H_2O. The low-energy γ rays of Co^{60} were used to obtain the ratio of electronic γ-ray cross sections. The ThC'' γ rays give rise to the same electronic cross-section ratio and in addition include the photodisintegration cross section. The photodisintegration cross section obtained for 2.62-Mev γ rays of the ThC'' was (1.47 ± 0.22) mb.

7258

THE MEAN SQUARE ANGLE OF EMISSION OF NUCLEONS IN HIGH ENERGY NUCLEON-NUCLEUS COLLISIONS. H. Messel and H. S. Green. Phys. Rev. 83, 1279(1951) Sept. 15. (Letter to the editor)

The problem of finding the mean square angle of emission of nucleons in high-energy nucleon-nucleon collisions was considered previously by the authors (Phys. Rev. 83, 842(1951); Proc. Phys. Soc. (London), to be published). The mean square angle of emission of nucleons resulting from a collision of a high-energy nucleon with a nucleus is now considered using the results obtained in the earlier work. The results of a calculation for light nuclei (including N and O) are plotted. It should be possible to estimate the energy of the primary nucleon from a statistic of the angles of secondary nucleons in high-energy photographic-plate stars.

7259

THE REACTION $C^{14}(p,n)N^{14}$: EXCITED STATES IN N^{15}. W. D. Roseborough, J. J. G. McCue, W. M. Preston, and C. Goodman. Phys. Rev. 83, 1133-6(1951) Sept. 15.

The relative neutron yield from $C^{14}(p,n)N^{14}$ has been measured for proton energies of 1100 to 2600 kev. Resonances occur at nine proton energies: 1165, 1310, 1664, 1789, 1883, 2024, 2079, 2272, and 2451 kev. The form of the yield curve and the calculated energies of the resonance levels in N^{15} are in good agreement with the results of others on the inverse reaction, $N^{14}(n,p)C^{14}$. (auth)

7260

THICK TARGET YIELDS FROM THE (d,n) REACTION AT 10 MEV. Lyle W. Smith and P. Gerald Kruger. Phys. Rev. 83, 1137-40(1951) Sept. 15.

The neutron yield from thick targets of Be, B, C, Al, Ni, Cu, Mo, Ta, W, Pt, and Au, bombarded with 10-Mev deuterons, has been determined by comparing the manganese activity ($MnSO_4$ in solution, in a large tank) after bombardment, with the activity produced by a standard Ra-Be source placed at the same position as the target. Some less reliable data on P, Mn, and Sb, obtained by a different method, are included. (auth)

7261

NEUTRON THRESHOLDS FROM THE REACTIONS $T^3(p,n)He^3$ $Li^7(p,n)Be^7$, $Be^9(d,n)^*B^{10}$, AND $O^{16}(d,n)F^{17}$. T. W. Bonner and J. W. Butler. Phys. Rev. 83, 1091-6(1951) Sept. 15.

Techniques are described for observing low energy (15 to 60 kev) "threshold" neutrons in the presence of fast neutrons. The threshold of the $T^3(p,n)He^3$ reaction was found to be 1020.3 kev, which gives a Q value of the reaction equal to −764.7 kev and a neutron-hydrogen mass difference of 783.2 kev. Interpretation of data near the threshold of the $Li^7(p,n)Be^7$ reaction gives indication of a level in Be^8 near 18.90 Mev. Three neutron thresholds have been observed in the reaction $Be^9(d,n)^*B^{10}$ at deuteron energies of 920, 985, and 1916 kev. The corresponding Q values are −752, −805, and −1566 kev; these give excited states in B^{10} at 5.110, 5.163, and 5.924 Mev. The threshold of the reaction $O^{16}(d,n)F^{17}$ was determined to be 1836 kev, giving a Q value of −1631 kev and a mass of F^{17} equal to 17.007506. (auth)

7262

SOME EXCITATION FUNCTIONS FOR PROTONS ON MAGNESIUM. J. W. Meadows and R. B. Holt. Phys. Rev. 83, 1257(1951) Sept. 15. (Letter to the editor)

The yield of Na^{22} as a function of energy for protons on Mg^{24}, Mg^{25}, and Mg^{26} has been determined. Bombardments were made on natural MgO and on MgO enriched in Mg^{25} and Mg^{26}, at initial energies of 100 and 70 Mev. The Mg reactions were monitored by comparing them with the known excitation curve for $Al(p,3pn)Na^{24}$. The three excitation functions are plotted. The emission of α particles is a

major mode of decay of these compound nuclei at low energies, but the emission of H^3 or He^3 is not very probable.

7263

THE HIGH ENERGY NUCLEAR PHOTOEFFECT. J. S. Levinger. Phys. Rev. 84, 43-51(1951) Oct. 1.

The nuclear photoeffect for photons of energy greater than 150 Mev is calculated assuming the two-nucleon model used by Heidmann. The main features of the nuclear photoeffect are then quite similar to those of the deuteron photoeffect. The cross section for nuclear absorption of a high-energy photon is about 1.6 A times the cross section for the deuteron photoeffect. The deuteron photoeffect gives a very strongly forward angular distribution for protons of a given energy, observed in the laboratory system. The angular distribution for protons from the nuclear photoeffect is almost as strongly forward: for 90-Mev protons in the laboratory system the ratio of the differential cross section at 60° to that at 90° is about 3. The proton-energy spectrum decreases rapidly with proton energy, and becomes steeper for observations at large angles. The absolute value of the differential cross section for 90-Mev protons from carbon at 30° (lab.) is about 0.2 μb/Mev steradian per Q, or about 20 μb/steradian/photon.

7264

EXCHANGE COLLISION OF FAST NUCLEONS WITH DEUTERONS. I. Pomeranchuk. Doklady Akad. Nauk S.S.S.R. 78, No. 2, 249-50(1951) May. (In Russian)

The reactions $n + D \rightarrow p + (n + n)$ and $p + D \rightarrow n + (p + p)$ are considered briefly for the case in which the direction of the fast nucleon following the collision agrees with the direction before collision. The triplet state is the only possible one for $(n + n)$ or $(p + p)$. Recent experimental results on scattering of 270-Mev neutrons by deuterium (Cladis et al., Bull. Am. Phys. Soc. 25, No. 6, 6(1950)) indicate that in the equation $(a' + b'\mathbf{s}_1\mathbf{s}_2)P = (a + bP_s(1,2))P$, where $P_s(1,2)$ is the spin-exchange operator, a is small compared with b or entirely absent. This indicates that all such reactions result in spin exchange.

7265

PHOTOPROTON REACTIONS IN LEAD. A. G. W. Cameron, W. Harms, and L. Katz. Phys. Rev. 83, 1264-5(1951) Sept. 15. (Letter to the editor)

The activation curve for the combined reactions $Pb^{208}(\gamma,p)Tl^{207}$, $Pb^{207}(\gamma,p)Tl^{206}$, $Pb^{208}(\gamma,d)Tl^{206}$, and $Pb^{208}(\gamma,pn)Tl^{206}$ has been measured up to 27 Mev. No attempt was made to separate the two half lives. The $Cu^{63}(\gamma,n)Cu^{62}$ activation curve served as monitor. The resulting activation curve was analyzed by the photon-difference method to determine the sum of the contributing photonuclear cross sections. A cross section maximum of 5.3 mb occurs at 26 Mev. Some theoretical conclusions are drawn regarding the contributions of the various reactions to the cross-section curve.

7266

ON THE PHOTONUCLEAR DISSOCIATION OF NUCLEI BY HIGH ENERGY GAMMA-RAYS. Seishi Kikuchi. Phys. Rev. 83, 1255-6(1951) Sept. 15. (Letter to the editor)

The stars produced in photographic emulsions exposed directly to a beam of synchrotron γ-rays were analyzed further (Phys. Rev. 80, 492(1950)) by using 6000-μ G-5 emulsions. The relative frequency of appearance of different types of events corresponding to excitation energies from 150 to 300 Mev are tabulated, and the energy distribution of protons is roughly indicated. The absolute cross section averaged over light and heavy atoms (except H) was determined as $6.1 \pm 0.3 \times 10^{-27}$ cm^2 at the excitation energy of 300 Mev. The angular distribution of protons from stars relative to the direction of the incident γ-ray beam was studied at the excitation energy of 300 Mev. The protons of energy between 20 and 60 Mev have a strong forward asymmetry and have a peak between 30 and 60°. The protons above 60 Mev also show some forward asymmetry. The results indicate that most of the stars produced by the photons of energy between 150 and 300 Mev are due to the production and absorption of a meson inside the nucleus.

7267

PHOTODISINTEGRATION OF He^4. T. S. Benedict and W. M. Woodward. Phys. Rev. 83, 1269-70(1951) Sept. 15. (Letter to the editor)

Cross sections for the production of protons from He^4, using the 300-Mev bremsstrahlung beam of the Cornell synchrotron, have been measured for proton energies ranging from 45 to 120 Mev. The apparatus consists of a pressure vessel with counting arms mounted at 60 and 90° with respect to the γ-ray beam. Two NaI(Tl) crystals are mounted inside each arm in such a way as to form a proton-counter telescope. Measurements made at 60° and 90° (lab.) for three proton energies at a gas pressure of 1800 lb/in^2 are plotted. If the predominant reaction is $\gamma + He^4 \rightarrow He^3 + p$, the cross sections at 101° (c.m.s.) per photon are $d\sigma/d\Omega = 25$, 17, and 14 μb at γ-ray energies of 78, 112, and 153 Mev, respectively.

7268

EFFECT OF TARGET THICKNESS IN THE SEARCH FOR H^4. J. S. McIntosh. Phys. Rev. 83, 1246(1951) Sept. 15. (Letter to the editor)

In connection with the search for H^4 by McNeill and Rall (Phys. Rev. 83, 1244(1951)) it was found necessary to estimate the ratio

$$R = [Y/\sigma(E_{max})]_H \Big/ [Y/\sigma(E_{max})]_{Li}$$

where Y is the total reaction yield, $\sigma(E_{max})$ is the collision cross section for the maximum energy of the bombarding deuterons (i.e., before they have been slowed down), and subscripts H and Li refer to the reactions $H^3(d,p)H^4$ and $Li^7(d,p)Li^8$, respectively. The yield is given by

$$Y = (N_\sigma/N)\int_{E_{min}}^{E_{max}} [\sigma/(\epsilon\sigma)]dE$$

where N_σ/N is the ratio of the number of nuclei taking part in the reaction to the total number in the target, σ the collision cross section, $\epsilon\sigma$ the stopping cross section, and E the energy of the bombarding deuterons. For the targets used $E_{(min)} \cong O$. Curves are drawn for R vs. Q for assumed Q values from −2.226 to +2.227 Mev and for energies of the bombarding deuterons of 3.825 and 4.1 Mev.

7269

THE POSSIBILITY OF THE REACTION $H^3(d,p)H^4$. Kenneth G. McNeill and Waldo Rall. Phys. Rev. 83, 1244-5(1951) Sept. 15. (Letter to the editor)

Experiments have been conducted to investigate the possibility of the reaction $H^3(d,p)H^4$. An air-cooled target of H^3 on Zr was bombarded by cyclotron deuterons of energies between 0.5 and 3.8 Mev. A search was made for the protons which would arise from the (d,p) reaction if it existed. A "peaked" proportional counter was used to detect protons at the end of their range. The following limits were deduced for the reaction: either the reaction's Q value is less than 4.4 Mev, which implies that the mass value of H^4 is greater than 4.019 amu, or the probability of the reaction is at most $\frac{1}{1500}$ that of the $H^3(d,n)He^4$ reaction. The β emission $H^4 \rightarrow He^4 + \beta^-$ would give rise to high-energy (~15 Mev) β rays with a likelihood of short half life. A search for these was made using a NaI(Tl) scintillation detector and deuterons of energy 3.82 and 4.1 Mev. Not a single H^4 β ray was observed.

7270

(d,n) REACTIONS WITH 15-MEV DEUTERONS. II. NEUTRON ENERGY SPECTRA AND YIELDS. B. L. Cohen and C. E. Falk. Phys. Rev. 84, 173-8(1951) Oct. 15.

Energy spectra of neutrons produced by bombarding several thick targets with 15-Mev deuterons were measured at various angles by observing proton recoils in photographic plates and in a triple coincidence-anticoincidence proportional-counter telescope. The spectra measured in or near the forward direction strongly indicate a stripping rather than a compound nucleus interaction, while for those measured at large angles the opposite is the case. Analyses of the shapes of the spectra at low energy and a study of the yields as a function of atomic number indicate that the stripping process is one in which the penetration of a coulomb barrier is important. This, together with an estimate of the relative cross sections for stripping and compound nucleus formation, also seems to favor a stripping process in which the proton is captured by nuclear forces rather than one in which the deuteron is broken up by electric forces. (auth)

7271

YIELDS OF α-, n-, AND γ-RADIATION FROM CHLORINE BOMBARDED WITH PROTONS. K. J. Brostrom and B. S. Madsen. Phys. Rev. 83, 1265-6(1951) Sept. 15. (Letter to the editor)

Targets of $PbCl_2$ were bombarded with protons. 86 γ resonances were found in the voltage region from 500 to 2150 kev. A few of the strongest of these peaks were also detected with targets of separated Cl. These peaks are: Cl^{35}: 858, 888, 1102, 1258, 1484, and 1510 kev; Cl^{37}: 1090 kev. Neutrons were searched for with boron-filled proportional counters surrounded by paraffin wax. In the voltage region from 1600 to 2300 kev, 47 neutron-emitting levels were found, the lowest situated at 1637 kev. Six of these resonances, 1928, 1974, 2014, 2028, 2079, and 2108 kev, were detected in Cl^{37} targets, whereas none was found in Cl^{35}. α particles were looked for with a proportional counter, magnetic deflection being used to separate α particles from scattered protons. In the interval from 1450 to 2040 kev, 10 resonances giving rise to α emission were found. The α particles are ascribed to the process $Cl^{37}(p,\alpha)S^{34}$.

7272

HIGH ENERGY NUCLEAR PHOTOEFFECT IN CARBON. D. Walker. Phys. Rev. 84, 149-50(1951) Oct. 1. (Letter to the editor)

The total nuclear cross section for the production of high-energy protons in a C target under bombardment by bremsstrahlung from an electron synchrotron is computed from data reported earlier (D. Walker, Phys. Rev. 81, 634(1951), NSA 5-3241). The relative integral proton spectra at 135, 90, 60, and 30° to the bremsstrahlung beam are shown. For E > 70 Mev the nuclear cross section $\sigma = 2.3 \pm 1.6 \times 10^{-28}$ cm^2 per unit Q. For E > 90 Mev, $\sigma = 9 \pm 6 \times 10^{-29}$ cm^2 per unit Q. A correction is made in the cross-section scale used in the earlier report.

7273

GAMMA-RAY SPECTRUM AND YIELD FROM TRITIUM BOMBARDED BY PROTONS. R. S. Rochlin. Phys. Rev. 84, 165(1951) Oct. 1. (Letter to the editor)

The energy spectrum and yield of the γ radiation from the reaction $T^3(p,\gamma)He^4$ has been measured with a γ-ray pair spectrometer. Tritium absorbed in a Zr target was bombarded by 0.96 ± 0.06-Mev protons. The γ rays were observed at an angle of 54° (lab.) to the proton beam. The energy region 3 to 22 Mev was surveyed using a Pb and then a Cu radiator. A single line was observed at 20.4 ± 0.2 Mev. A Q value of 19.7 ± 0.3 Mev was obtained for the reaction. The yield from the $T^3(p,\gamma)He^4$ reaction was measured relative to the 17.6-Mev γ rays from the $Li^7(p,\gamma)Be^8$ reaction using the pair spectrometer. Correcting for the variation of spectrometer efficiency with energy, a (T + Zr)/Li yield ratio of 0.016 ± 0.004 was found. The absolute yield of the T + Zr target at 90° was about 3×10^{-11} γ ray per steradian per proton.

7274

GAMMA-RAY SPECTRUM FROM THE DEUTERON BOMBARDMENT OF C^{13}. L. M. Baggett and S. J. Bame, Jr. Phys. Rev. 84, 154(1951) Oct. 1. (Letter to the editor)

A thick target of C enriched to 35% C^{13} was bombarded with 1.65-Mev deuterons, and the γ rays were observed at 90° to the beam by means of a 180° magnetic pair spectrometer. A tin radiator was used. The four calculated line energies and yields (uncorrected for relative abundance) are tabulated and compared with those obtained by Thomas and Lauritsen (Phys. Rev. 78, 88(1950)) with a magnetic-lens spectrometer. The 3.05 ± 0.09-Mev line is assigned to $C^{12}(d,p)C^{13}$, the 3.40 ± 0.15- and 5.04 ± 0.09-Mev lines to $C^{13}(d,n)N^{14}$, and the 6.10 ± 0.10-Mev line to $C^{13}(d,p)C^{14}$.

PARTICLE ACCELERATORS

7275

Radiation Lab., Univ. of Calif.

ACCELERATOR OPERATION AND DEVELOPMENT, p.19-25 of PHYSICS DIVISION QUARTERLY REPORT; MAY, JUNE, AND JULY, 1951. Sept. 24, 1951. 7p. (UCRL-1474 (p.19-25))

Routine operation of the particle accelerators is discussed. Installation of new equipment, including a new 24-in. diffusion-pump gate mechanism, is reported, and difficulties encountered in operation of the synchrotron are discussed. A typical range-energy curve for C_{12}^{+6} ions in Ta absorbers is shown. Using known Hρ's for α, deuterium, and He particles, those for C_{12}^{+6}, C_{12}^{+2}, C_{13}^{+6}, and C_{13}^{+2} were calculated with aid of the field plots. The resolution of the components for C^{12} is plotted as a function of magnet current.

7276

A 200-KV NEUTRON GENERATOR. Nils Göran Sjöstrand. Applied Sci. Research (Netherlands) 2B, No. 3, 227-40(1951).

In this neutron generator, deuterium ions are produced in a high-frequency ion source and accelerated through 200 kv onto a heavy-ice target where the neutrons are produced by the $D(d,n)He^3$ reaction. The neutrons emitted have energies in the range 2 to 3 Mev and an average yield equivalent to that of a 10-c RaBe source. The apparatus has been used for irradiation experiments requiring stable operation over a period of several hours. 12 figures.

7277

THE LINEAR ELECTRON ACCELERATOR AS A PULSED NEUTRON SOURCE. B. T. Feld. Nucleonics 9, No. 4, 51-7(1951) Oct.

The linear electron accelerator has been studied as a pulsed neutron source with a pulse of 1 μsec and currents up to 100 ma. Such an accelerator can be utilized to produce pulsed neutron sources for time-of-flight neutron velocity selectors. Data for Cu, Ag, and Ta used in the preliminary tests are graphed and tabulated.

7278

THE SYNCHROCYCLOTRON AT AMSTERDAM. III. THE ELECTROMAGNET. F. A. Heyn. Philips Tech. Rev. 12, 349-64(1951) June.

A description is given of the magnet (core, coils, and cooling system) supplying the powerful field for the Philips synchrocyclotron. (See also NSA 5-5911 for Parts I & II.)

7279

RADIO FREQUENCY FOR A SYNCHROCYCLOTRON. Alfred J. Poté. Electronics, 24, No. 11, 100-5(1951) Nov.

The general problems of design and construction of oscillators and modulators for synchrocyclotrons are described. Brief mathematical notes supplement the description, which includes a short explanation of the basic principles of cyclotrons and synchrocyclotrons.

RADIATION ABSORPTION AND SCATTERING

7280
Radiation Lab., Univ. of Calif.
GENERAL PHYSICS RESEARCH, p.3-10 of PHYSICS DIVISION QUARTERLY REPORT; MAY, JUNE, AND JULY, 1951. Sept. 24, 1951. 8p. (UCRL-1474(p.3-10))

90-Mev neutrons were collimated to enter a cloud chamber filled with He gas to a total pressure of 81 cm Hg. So far, with only a limited number of events analyzed, it appears that t-p events predominate among the inelastic collisions, t-d events occur fairly frequently, and He^3, d-d, and p-d occur less frequently. In the present sample of 59 2-prong stars, no p-p events have been found. He^4 recoils occur somewhat more frequently than the p-t events. Examination of ~500 positron tracks, after μ-meson decay, has yielded the following results: E_{av} = 33 ± 2.5 Mev; E_{max} = 54 ± 2.5 Mev; $E_{max\ probability}$ = ~35 Mev. The p-p part of the inelastic d-p differential-scattering cross section was extended to 37 and 25° (lab.), and repeated at 45 and 30°. The total d-p cross section was remeasured by placing a single crystal at various distances from the beam. The total cross section is 95 ± 7 mb. This is a lower limit. The experiment on proton elastic scattering has been completed and angles of maximum and minimum scattering are tabulated for C, Mg, Al, Si, S, Cu, Ag, W, Ta, Pb, and Bi.

7281
Radiation Lab., Univ. of Calif.
GENERAL PHYSICS RESEARCH, p.10-18 of PHYSICS DIVISION QUARTERLY REPORT; MAY, JUNE, AND JULY, 1951. Sept. 24, 1951. 9p. (UCRL-1474(p.10-18))

Studies of the γ-ray spectrum arising from high-energy proton bombardment of cyclotron targets have suggested that some contribution of high-energy γ radiation from processes other than π^0 decay may be present. The development of a fast electronic counting technique has permitted the identification of π^- mesons which are produced when photons from the synchrotron impinge on a target containing deuterium nuclei. The difference in the counting rates from heavy- and ordinary-water targets indicate that at least two ionizing particles are produced as the result of the interaction of a photon with the neutron in the deuteron. The noncentral force nature of the elastic n-p interaction at high energies (150 Mev) has been demonstrated by detecting an azimuthal polarization in a double-scattering experiment. Stars produced in nuclear emulsions by C^{12} and C^{13} ions accelerated in the 60-in. cyclotron are being studied and a calculation of cross section for charged-particle emission with respect to the mixture of nuclei in the emulsion has been completed for part of the events. For C^{12}, 102 events occurred in 181,000 tracks, corresponding to a cross section of 0.40 barns with a statistical probable error of 0.03 barns. For C^{13}, 108 events were found in 188,000 tracks, giving a cross section of 0.37 ± 0.03 barns

7282
Rochester Univ.
240-MEV. PROTON-DEUTERON SCATTERING; by Robert D. Schamberger. Oct. 5, 1951. 13p. (NYO-3027)

A scattering apparatus within the tank of the 130-in. cyclotron has been used to investigate proton-deuteron scattering by measuring coincidences between the proton and deuteron in elastic scattering and the two protons in inelastic scattering. The incident beam was measured by measuring the C^{11} β activity produced in the heavy-paraffin targets. The differential elastic-scattering cross section was obtained from 20.5 to 100° for the proton scattering angle in the center-of-mass system. That portion of the inelastic scattering which results in a low-energy neutron was investigated. The differential cross section for this quasi-proton-proton scattering was obtained at three angles in the center-of-mass system of the two protons. The cross section, equal to about one half of the free p-p cross section at 90°, decreases as the proton scattering angle decreases. A total quasi-p-p cross section of 11 ± 3 mb was obtained. Maximum energies for the low-energy neutron distribution were obtained at laboratory neutron angles of 0, 90, and 180° with respect to the incident proton direction, for proton scattering angles of 40, 67, and 90° in the p-p center-of-mass system. (auth)

7283
Rochester Univ.
NEUTRON STARS IN KRYPTON; by J. K. Bøggild and F. H. Tenney. Oct. 9, 1951. 6p. (NYO-3029)

Approximately 200 neutron stars have been observed in an 8-in. Wilson cloud chamber filled with Kr to about 1 atm of pressure. The neutrons were produced in the forward direction by 240-Mev protons bombarding Cu or Be targets in the Rochester cyclotron. The prong distribution found for the Kr stars is compared with those previously reported (Phys. Rev. 82, 307(1951)) for O, Ne, and A. The relative number of stars with two prongs is considerably higher in Kr. An attempt to obtain a classification of the ejected charged particles has been made by a combined judgment of the track width and density and the number of delta rays. The α/proton ratios in the stars are as follows: 2 prong, 0.11; 3 prong, 0.29; 4 prong, 0.21; all stars analyzed, 0.21. The α/proton ratio for each type of star decreases with increasing atomic number as shown by a comparison of the ratios for O, Ne, A, and Kr.

7284
Rochester Univ.
HIGH ENERGY NEUTRON COLLISIONS WITH HELIUM; by Clifford H. Swartz. June 1951. 19p. (NYO-899)

A cloud chamber investigation was made of high energy neutron collisions with He. Observations were made of 377 elastic recoils and 126 disintegrations. Two groups were selected from the elastic collisions according to the energy of the incident neutron, estimated from the appearance and delta-ray structure of the recoiling α-particle track. The scattering by neutrons in the 10- to 30-Mev range appeared roughly isotropic in the center of mass, while neutrons with energy greater than 50 Mev were scattered strongly in the forward direction. An absence of evidence for neutrons scattered at very small angles was noted. The general appearance of He disintegrations is described. This seems different from that predicted by one theory of neutron-helium collisions. (auth)

7285
Rochester Univ.
PROTON-PROTON SCATTERING AT 240 MEV; by C. L. Oxley and R. D. Schamberger. Oct. 3, 1951. 9p. (NYO-3026)

Differential p-p scattering cross sections have been measured at six angles in the range from 27 to 90° center of mass. The internal undeflected cyclotron beam was used with a hydrocarbon target. The p-p scattering was differentiated by detecting the emitted proton pair with its definite angle between particles in coincidence with two scintillation counters. The incident beam was monitored by measurement of the C^{11} β activity induced by the reaction C^{12} (p,pn)C^{11} in the target. The cross sections measured show isotropy in the center-of-mass system within estimated errors. The average value of the cross section was 4.97 ± 43 mb/steradian based on a 49 ± 3 mb carbon cross section. This is in poor agreement with previous measurements of 3.6 ± 0.2 b/steradian. (auth)

7286
FURTHER RESULTS ON THE FLUCTUATION PROBLEM IN ELECTRON-PHOTON CASCADE SHOWER THEORY AND

THE PROBABILITY DISTRIBUTION FUNCTION. H. Messel. Proc. Phys. Soc. (London) 64A, 807-13(1951) Sept.

Results are presented both for the fluctuation and distribution of electrons in electron-photon cascade shower theory. The results were obtained in approximation A, i.e., when ionization loss by electrons was neglected, and are for the case of a single primary electron giving rise to the shower. (auth)

7287

ON THE IDENTITY OF β RAYS WITH ELECTRONS. W. T. Davies and M. A. Grace. Proc. Phys. Soc. (London) 64A, 846-7(1951) Sept. (Letter to the editor)

An examination was made of the bremsstrahlung radiation from the β rays emitted by a source of H^3 absorbed in a thin layer of Zr in which effectively all the β rays were stopped. The pulse-height distribution due to tritium β rays stopped in Zr and the distribution for the Bi L x rays were plotted. The graph failed to reveal any trace of an x-ray line in the expected region of 16 kev, therefore it can be concluded that, in the case of the β rays of H^3, not more than a few in a million can be other than electrons at a time of the order 10^{-14} sec after disintegration.

7288

SMALL-ANGLE SCATTERING OF 3.27-MEV NEUTRONS BY DEUTERONS. I. Hamouda and G. De Montimollin. Phys. Rev. 83, 1277(1951) Sept. 15. (Letter to the editor)

The angular distribution of 3.27-Mev neutrons scattered by deuterons in a cloud chamber has been measured from 18 to 70° in the center-of-mass system. The data from an earlier experiment (Hamouda et al., Phys. Rev. 79, 539 (1950)) are included for the range 50 to 180°. The graph shows that more neutrons are scattered forward than backward, in disagreement with the theoretical distributions of Massey and Buckingham (Phys. Rev. 71, 558(1947)).

7289

CHARGE EXCHANGE SCATTERING OF π-MESONS IN DEUTERIUM. Benjamin Segall. Phys. Rev. 83, 1247-8 (1951) Sept. 15. (Letter to the editor)

The exchange-scattering cross section of fast π mesons of spin zero in deuterium, $\pi^+ + d \rightarrow p + p$, is calculated by the impulse-approximation method. It is shown that the deuteron cross section cannot be larger than the neutron cross section, and that the deuteron cross section is directly expressible in terms of the corresponding single-nucleon cross section. The relevant weak-coupling single-nucléon cross sections for the various possible combinations of parities of spin-zero neutral and charged mesons are listed. The total cross sections at several energies for the case of spin coupling for the π^+ and π^0 meson are tabulated for both the deuteron and single-nucleon reactions.

7290

NEUTRON DIFFRACTION BY THE GASES N_2, CF_4, AND CH_4. N. Z. Alcock and D. G. Hurst. Phys. Rev. 83, 1100-5 (1951) Sept. 15.

Neutron diffraction patterns for the gases nitrogen, carbon tetrafluoride, and methane are given for a neutron wavelength of 1.063 A. It is found that the coherent scattering cross sections of nitrogen and fluorine are nearly equal to the total cross sections, and that the C − F bond length in carbon tetrafluoride is 1.33 A. The error in a semiclassical form of the differential scattering cross section is discussed. (auth)

7291

FIELD CORRECTIONS TO NEUTRON-PROTON SCATTERING IN A NEW MIXED MESON THEORY. D. B. Beard and H. A. Bethe. Phys. Rev. 83, 1106-14(1951) Sept. 15.

The principal relativistic correction to neutron-proton scattering has been computed to fourth order for nonrelativistic energies by calculating the matrix elements using the Feynman method and then subtracting off the appropriate order Born approximation to the Yukawa potential. A new meson theory was used, namely a mixture of pseudovector mesons and pseudoscalar mesons with pseudovector coupling; it is shown that by suitable choice of the coupling constants the divergent terms could be eliminated in all orders (disregarding possible electromagnetic couplings). The mesonic field corrections to neutron-proton scattering were found to be of order μ/M smaller than the static Yukawa potential cross section; in practical applications, they could be treated as a perturbing potential to the static Yukawa interaction. (auth)

7292

MAGNETIC NEUTRON DIFFRACTION FROM EXCHANGE-COUPLED LATTICES AT HIGH TEMPERATURES. M. Slotnick. Phys. Rev. 83, 1226-30(1951) Sept. 15.

The magnetic scattering of slow neutrons from a crystal lattice with exchange coupling at temperatures much higher than the (ferromagnetic or antiferromagnetic) Curie point is investigated. The residual short-range order is shown to manifest itself in coherent and inelastic effects, which are calculated by means of an expansion in $1/T$. These effects can yield information on the strength of the exchange interactions, the ratio of nearest-neighbor to next-nearest-neighbor interactions, etc. Conditions for the observability of these effects are more favorable in the antiferromagnetic case. (auth)

7293

ABSORPTION BY ALUMINUM IN THE SOFT X-RAY REGION. D. H. Tomboulian and E. M. Pell. Phys. Rev. 83, 1196-1201 (1951) Sept. 15.

Measurements on the absorption by aluminum in the spectral range extending from 80 to 600 A have been carried out by the use of a grazing-incidence spectrograph. The investigation has revealed that the strong absorption band centered at 129 A is a "surface" phenomenon which takes place in the metal-substrate interface of absorbers prepared by evaporation. Thin metallic foils without a substrate do not show this absorption band. The present data have yielded consistent results for the mass-absorption coefficient, whose value ranges from 1.0×10^4 cm^2/g to 2.8×10^4 cm^2/g in the foregoing spectral region. As observed previously in connection with the K edge, a secondary structure is also present on the short wavelength side of the $L_{2,3}$ edge. The L_1 absorption limit has not been detected. (auth)

7294

THE ENERGY LOSS OF ELECTRONS PASSING THROUGH MATTER. J. J. L. Chen and S. D. Warshaw. Phys. Rev. 84, 355-61(1951) Oct. 15.

A discussion of the results of a study of the stopping properties for moderately energetic (≤1.0-Mev) electrons is given, with special emphasis placed on the distribution in energy loss for a finite thickness of stopping material. Several theoretical expressions (Bethe-Bloch-Williams, Landau, Blunck-Leisegang) are compared with the data on the value of the most probable loss. A correction for polarization effects (e.g., in Be) can be made if the dependency of the mean excitation potential on velocity is known. The stopping properties of some materials used as, e.g., counter windows, have also been determined. (auth)

7295

NOTE ON THE RELATIVISTIC FORMULA FOR PHOTOELECTRIC ABSORPTION. Harvey Hall. Phys. Rev. 84, 167-8(1951) Oct. 1. (Letter to the editor)

It is pointed out that the relativistic photoeffect formula $\frac{\phi_k}{\phi_0} \cong \frac{3}{2}\frac{Z^5}{137^4}\frac{\mu}{k}\exp\left[-\pi\alpha + 2\alpha^2(1-\log\alpha)\right]$ (Heitler's notation in "The Quantum Theory of Radiation" (2nd ed.) Oxford, Clarendon Press (1945)) was derived (Hall, Phys. Rev. 45, 620(1934)) by rigorous treatment, and that its validity has

also been extended to the high-energy limit (Revs. Modern Phys. 8, 395(1936)).

7296
THE INELASTIC SCATTERING OF FAST NEUTRONS IN LEAD AND BISMUTH. B. G. Whitmore and G. E. Dennis. Phys. Rev. 84, 296-7(1951) Oct. 15.

The energy spectrum of 14-Mev neutrons from the (T–D) reaction after transmission through 6 cm of lead, or bismuth, has been measured by the photographic emulsion method. Approximate agreement with the Weisskopf theory is found, the nuclear temperatures being 0.8 Mev for lead, 0.9 Mev for bismuth. In lead, there is some indication of a group with a discrete loss of energy of about 5 Mev. (auth)

7297
ON THE POLARIZATION OF HIGH ENERGY BREMSSTRAHLUNG AND OF HIGH ENERGY PAIRS. Michael M. May. Phys. Rev. 84, 265-70(1951) Oct. 15.

The polarization of bremsstrahlung due to electrons with initial energies much larger than $137Z^{-\frac{1}{3}}mc^2$ is calculated under relativistic, small angles approximations. The cross section for photons polarized normally to the plane containing the initial directions of the electron and the direction of the photon is found to be larger than for photons polarized in that plane. A similar calculation shows that the plane containing one of a pair produced by a polarized photon together with the direction of that photon tends to lie parallel to the plane of polarization rather than normal to it, except for one special case. The effect of the deviation due to multiple scattering of electrons in the target upon the angular dependence of the polarization is considered. (auth)

7298
SCATTERING OF SLOW NEUTRONS BY H_2 AND CH_4. Albert M. L. Messiah. Phys. Rev. 84, 204-14(1951) Oct. 15.

The mass tensor approximation, introduced by previous authors to calculate the scattering cross section of slow neutrons by molecules when the incident energy E_0 of the neutron is large compared with the average level spacing of the molecular rotations, is extended here to take into account the molecular vibrations. Calculations are made in the case of H_2 and CH_4 at room temperature for neutron energies below the thresh old of excitation of higher vibrational states. The agreement with experiment is very satisfactory in the expected range of validity of this theory. The cross section for higher E_0 is also treated in the case of H_2, without taking into account, however, the thermal agitation of the scattering molecules: the asymptotic form of the total cross section for large values of E_0 is derived, and numerical calculations show that the asymptotic behavior is quickly reached. (auth)

7299
SCATTERING OF π-MESONS BY THE DEUTERON. John S. Blair. Phys. Rev. 83, 1246-7(1951) Sept. 15. (Letter to the editor)

The scattering of charged spin-zero mesons by the deuteron has been examined in the weak-coupling approximation and compared with the familiar weak-coupling results for single-nucleon scattering. The chief interference effect occurs because the calculated scattering amplitudes from single neutrons and protons have nearly the same magnitude but may be of differing sign. Thus, large destructive or constructive interference may arise in the scattering amplitude of the deuteron, which for low-energy mesons is a sum of single-nucleon amplitudes. An additional minor interference effect arises from the fact that the Pauli exclusion principle must operate in intermediate states. The results of the calculations of elastic- and inelastic-scattering cross sections for scalar coupling and for pseudovector coupling are summarized.

RADIATION EFFECTS

7300
ELECTRON MOBILITIES IN LIQUID ARGON. M. S. Malkin and H. L. Schultz. Phys. Rev. 83, 1051-2(1951) Sept. 1. (Letter to the editor)

A parallel-plate chamber immersed in liquid argon has been used to measure the mobility of electrons resulting from the ionization of liquid argon by the α particles of ThC (Bi^{212}) and ThC′ (Po^{212}). Pulses resulting from electron collection were amplified and used to trigger the sweep of a fast synchroscope. The graph of electron mobility vs. electric field (E) for two plate separations is in good agreement with the theoretical curve which assumes the mobility to be proportional to $E^{-\frac{1}{2}}$. The collision cross section obtained for electrons of 10 v mean energy is about 100 times smaller than the published values for the gas (Brode, Revs. Modern Phys. 5, 263(1933)). Preliminary results in solid argon indicate an electron multiplication by a factor greater than 10.

RADIOACTIVITY

7301
Radiation Lab., Univ. of Calif.
SOME COMMENTS ON THE MECHANISM OF FISSION; by Glenn T. Seaborg. July 25, 1951. Decl. Oct. 25, 1951. 9p. (AECD-3261; UCRL-1409 (Rev.))

A correlation of spontaneous-fission rates with the fissionability parameter Z^2/A, from Th to Cm, shows that these rates depend on the nuclear type. Some suggestions as to the mechanisms are given and it is also shown how these relate to the mechanism of slow-neutron and photofission.

7302
Ames Lab.
SOME SYNCHROTRON PRODUCED RADIOACTIVITIES OF TANTALUM; by Alfred J. Moses and Don S. Martin. Dec. 1950. 36p. (ISC-158)

X-ray irradiation of W by a synchrotron beam has produced three radioactive isotopes of Ta with half lives of 48 min (Ta^{185}), 8.0 hr (Ta^{180}), and 6.0 days (Ta^{183}). Characteristics of the activities were studied by absorption and coincidence measurements. Separated W^{182} was used for the identification of the Ta^{180}. Relative yields of the three isotopes were measured for beam energies of 30 and 68 Mev. In addition, the yields for 68 Mev were compared to the yield of the reaction $C^{12}(\gamma,n)C^{11}$. Ta^{180} is apparently formed only by the reaction $W^{182}(\gamma,np)Ta^{180}$, but its yield is comparable to the yield of isotopes formed by (γ,p).

7303
Ames Lab.
RADIATION STUDIES, STUDIES OF NUCLEI, AND THEORETICAL PHYSICS, p. 7-19 of PROGRESS REPORT IN PHYSICS FOR THE PERIOD JANUARY 1, 1951, TO JUNE 30, 1951; by G. W. Fox, W. C. Caldwell, et al. Sept. 17, 1951. 13p. (ISC-175(p. 7-19))

The nuclear physics group has redetermined the maximum β-ray energies of Ag^{112} and Ag^{113} and obtained 3.6 and 2.0 Mev, respectively, for these activities. X irradiation of argon with the 70-Mev synchrotron produces an activity of 160-sec half life which has been tentatively assigned to A^{39}. Irradiation of Zr produces activities so complex that the nuclear reactions have not yet been identified. Fe^{53} is shown to have a half life of 10 min, a ft product of $8(10^4)$ sec, and a positron spectrum with an upper limit of 2.6 Mev. Radioactive P^{33} has been identified by studying five different reactions producing radioactive P. The ratio of initial activity of P^{33} to P^{32} in carrier-free

P^{32} is about 1.4%. P^{33} is formed by the reaction $S^{33}(n,p)P^{33}$ and is found to decay with a half life of 24.8 days by negatron emission with a maximum β energy of 0.26 Mev. The end point, half life, and ft values have been determined for each of seven nuclei which decays to its "mirror" nucleus by positron emission. The tabulated results appear to obey Wigner's theory. Pr^{140} decays with a half life of 3.4 min and is a positron emitter whose β-ray end point is 2.35 Mev. The ionization yields of heavy particles have been studied theoretically. No data are given, but a qualitative explanation is offered to account for the observation that the energy of fission is greater than that estimated from ionization measurements. The lattice specific heats of a face-centered structure and of a hexagonal close-packed structure have been calculated and shown to be different. The decay of a nucleus from one I = 0 state to another, with a change of parity, requires emission of two quanta, one or both of which may be internally converted. Theoretical calculations based on a maximum electron energy of 0.3 Mev and energy of the effective virtual intermediate level of the nucleus of 2.2 Mev gave decay rates as follows: for 2-quantum decay, 3.1/sec; for 2-electron decay, 1.4×10^{-3}/sec; and a lifetime for the metastable state (including possibility of decay by one quantum and one electron) of 0.22 sec.

7304

Radiation Lab., Univ. of Calif.

THE DECAY SERIES Nd^{140}-Pr^{140}-Ce^{140}; by Charles I. Browne, John O. Rasmussen, Joseph P. Surls, and Donald F. Martin.

Nd^{140} was prepared by bombardment of praseodymium oxide with 19-Mev deuterons, followed by chemical separations. The decay chain Nd^{140}-Pr^{140}-Ce^{140} was studied on a double-focusing β-ray spectrometer, a bent-crystal x-ray spectrometer, and a scintillation-crystal γ spectrometer. An internally consistent solution based upon the data obtained, Rose's theoretical L/K ratios, and theoretical values for f_k leads to the conclusion that Nd^{140} decays 26% by L capture and 74% by K capture; that Pr^{140} decays 58% by β^+ emission, 37% by K capture, and 5% by L capture; that the ratio of β^+/K in Pr^{140} is 1.5/1, and that the decay energy of Nd^{140} is 105 ± 40 kev. Probable states of the odd neutron and odd proton in Pr^{140} are considered, and the over-all state of Pr^{140} seems to be S_1. The mean K fluorescent yield at Z = 58 and 59 is very high, probably at least 0.95.

7305

NOTE ON EXPERIMENTAL DETERMINATION OF THE HALF-LIFE OF ^{8}Be. J. J. Wilkins and F. K. Goward. Proc. Phys. Soc. (London) 64A, 849-50(1951). Sept. (Letter to the editor)

Examination of the narrow V-shaped γ particle tracks from 280 similarly formed Be^8 nuclei from $O^{16}(\gamma,4\alpha)$ stars lead to the two conclusions: closely neighboring tracks of this kind can be resolved only sufficiently to allow an upper limit of about 5×10^{-14} sec to be obtained for the half life of Be^8, and the degree of scattering evident in the tracks is sufficient to produce an occasional illusion of a single Be^8 track.

7306

SECULAR CHANGES IN THE CHEMICAL COMPOSITION OF THE EARTH. G. V. Voĭtkevich. Priroda, No. 4, 28-37(1951). (In Russian)

Radioactive decay, induced nuclear transformations, loss of gases to space, and accretion from meteorites change, over ages, the relative proportions of elements making up the earth. These processes are discussed, and elements now increasing or decreasing in amount are listed.

7307

THE CONVERSION AND AUGER ELECTRONS OF RADIUM D. D. K. Butt and W. D. Brodie. Proc. Phys. Soc. (London), 64A, 791-6(1951) Sept.

The conversion and Auger electrons of RaD (Pb^{210}) have been studied in a lens β-ray spectrometer with a post-focusing electron accelerator. The number of conversion electrons due to the 46.7 kev γ ray is found to be 59.2 ± 5 per 100 disintegrations but reasons are given which suggest that this value be regarded as a lower limit. The Auger electrons have been compared with those resulting from the ThB-ThC (Pb^{212} - Bi^{212}) transition.

7308

AN INVESTIGATION OF THE REACTION ^{9}Be(d,p). A. J. Salmon. Proc. Phys. Soc. (London) 64A, 848-9 (1951) Sept. (Letter to the editor)

The proton group emitted from the reaction $Be^9(d,p)Be^{10*}$ was observed and the Q value (1204 kev) of the reaction determined from the measured momentum of the group. The cross section of this reaction was estimated to be σ_{-28} (90°) = 0.43 ± 0.09 × 10^{-28} cm^2/sterad at 301 kev and σ (90°) = 2.96 ± 0.59 × 10^{-28} cm^2/sterad at 440 kev. A Q value of 4.55 ± 0.03 Mev was obtained for the reaction $Be^9(d,p)Be^{10}$.

7309

DEUTERON BOMBARDMENT OF NEON. R. Middleton and C. T. Tai. Proc. Phys. Soc. (London) 64A, 801-7(1951) Sept.

Measurements were made of the energy of the emitted particles in the reactions $Ne^{20}(d,p)Ne^{21}$, $Ne^{22}(d,p)Ne^{23}$, $Ne^{20}(d,\alpha)F^{18}$, and $N^{22}(d,\alpha)F^{20}$. Histograms were plotted of the energy distribution for both the emitted proton and α particles for each of the ten measurements, in the range from 30 to 150°. Results are tabulated: for the reactions, $Ne^{20}(d,p)Ne^{21}$ and $Ne^{22}(d,p)N^{23}$ for the various proton groups, for the reactions $Ne^{20}(d,\alpha)F^{18}$ and $Ne^{22}(d,\alpha)F^{20}$ for the various α groups, and for the incident deuteron energy as deduced from the range of the elastically scattered deuterons.

7310

THE DISINTEGRATION SCHEME OF Au^{199}. P. M. Sherk and R. D. Hill. Phys. Rev. 83, 1097-1100(1951) Sept. 15.

The disintegration of 3.3-day Au^{199} has been investigated using β-ray spectrometers and counting techniques. The β-ray spectrum was observed to be complex. Determinations were made of the conversion electron and γ-ray intensities of three γ-transitions of 50, 159, and 209 kev. A consistent disintegration scheme is given. (auth)

7311

A PROTON-GAMMA-RAY COINCIDENCE STUDY OF Si^{30} AND B^{11}. H. H. Landon. Phys. Rev. 83, 1081-4(1951) Sept. 15.

The excited states of the Si^{30} and B^{11} nuclei were studied by means of a proton-gamma-ray coincidence technique for the purpose of determining the nature of the gamma-ray decay scheme. The nuclei were formed under cyclotron bombardment using the $Al^{27}(\alpha,p)Si^{30}$ and $B^{10}(d,p)B^{11}$ reactions. The transitions from the first two excited states of Si^{30} are directly to the ground state, while the transition from the third excited state takes place by means of a cascade to the second state and then to the ground state. The decay scheme in the B^{11} nucleus is most likely the same as for the Si^{30} nucleus for the first two excited states, while the third and the prolific fifth and sixth states show cascade transitions as most probable. (auth)

7312

A NOTE ON THE THEORY OF DIRECTIONAL CORRELATION. K. Alder. Phys. Rev. 83, 1266-7(1951) Sept. 15. (Letter to the editor)

The correlation $W(\theta)$ of two successive emissions of any nuclear particles is expanded in Legendre polynomials: $W(\theta) = \Sigma\ a_k P_k\ (\cos\theta)$. Here a_k is a product of 2 factors, I_k and II_k, which are dependent only upon the first and upon the second of the two transitions, respectively. The influence of the magnetic field of the electronic shells on the angular correlation is considered. An application is discussed which permits the determination of the multipole order and the character of an electromagnetic transition.

7313
SOURCES OF RADIATION. William C. Parkinson. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.35-44.

Principal sources of radiation are discussed. Types of radiation are defined, and sources of each discussed in detail. The history of the production of artificial radioactivity is summarized and present methods of production are reviewed.

7314
ELECTRON-GAMMA-ANGULAR CORRELATION MEASUREMENTS IN RADIOACTIVE DECAY. Donald T. Stevenson and Martin Deutsch. Phys. Rev. 83, 1202-7(1951) Sept. 15.

The beta-gamma angular correlations in the decay of a number of nuclides have been studied as a function of the beta-ray energy. Isotropic correlations were found in the decay of Co^{55}, Co^{56}, Co^{60}, Na^{22}, Na^{24}, Cs^{134}, and I^{124}. Nonisotropic correlations have been measured in the decay of Rb^{86}, Sb^{124}, and I^{128}. The interpretation of these results in terms of the properties of the emitted radiations and the nuclear-energy states is discussed. A nonisotropic conversion electron-gamma angular correlation was found in the decay of Mo^{93}. (auth)

7315
HALF-LIFE OF Li^8. Waldo Rall and Kenneth G. McNeill. Phys. Rev. 83, 1244(1951) Sept. 15. (Letter to the editor)

The half life of Li^8 produced by the (d,p) reaction on Li has been measured as 0.825 ± 0.02 sec. A 0.5-μa beam of 4-Mev cyclotron deuterons was used. After 3 sec irradiation of the Li, the beam was instantaneously cut off by breaking the r-f power supplies to the cyclotron. A NaI(Tl) crystal and photomultiplier were used to detect the β rays from Li^8 which passed through 2.5 g/cm^2 of brass before entering the crystal. The pulses from the photomultiplier were fed through conventional circuits to two scalers. The pulses from the scalers were fed to the Y plates of a self-triggered CRO adjusted to have a sweep speed of 100 μsec. The data displayed on the CRO were recorded by means of a shutterless movie camera.

7316
β-RAY SPECTRUM AND THE ft VALUE IN THE SECOND FORBIDDEN TRANSITION. Seitaro Nakamura, Minoru Umezawa, and Hisao Takebe. Phys. Rev. 83, 1273-4(1951) Sept. 15. (Letter to the editor)

An attempt is made to reinterpret the forbidden spectra of Tc^{99} and Sb^{124} by using a correction factor $C_{2T} \sim k^2\,(3a) + (1/12)\,(3D_+ - c) - kE$, where a, $3D_+ - c$, and E are as defined in Konopinski's paper (Revs. Modern Phys. 15, 209(1943))

$$k^2 = \Sigma\left|A_{ij}\right|^2 \Big/ \Sigma\left|T_{ij}\right|^2.$$

In the case of Tc^{99}, if k = 7.7 the Fermi plot becomes a straight line from the maximum energy to W = 1.35 mc^2. For Sb^{124}, k = 13 results in a straight-line forbidden Curie plot down to W = 4 mc^2 for the highest-energy β ray. The ft values of β decay in the second-forbidden transition are tabulated for Cl^{36}, Tc^{99}, and Sb^{124}. It is noted that the empirical ft values of different transitions, i.e., the allowed ($\int\sigma$), the first forbidden (σB_{ij}), and the second forbidden (σT_{ij}), fall into distinct groups, 10^4, $10^8 \sim 10^9$, and $10^{12} \sim 10^{13}$, respectively.

7317
RADIOACTIVITY OF THE HEAVY ELEMENTS. A. G. Maddock. Quart. Revs. 5, No. 3, 270-314(1951).

The literature on the radioactivity of heavy elements ($Z \geq 79$) has been reviewed. The review describes briefly the development of radioactive decay series and important techniques, especially in electronic instrumentation, which has aided the progress in this field. 206 references.

7318
FISSION-PRODUCT DECAY RATES. H. F. Hunter and N. E. Ballou. Nucleonics 9, No. 5, C2-7(1951) Nov.

Calculations have been made of the total β and γ radiation emitted by fission products within 28 different time intervals after simultaneous fission of a number of U^{235} atoms. The decay rates $A_x(t)$ for each fission product x at time t after slow-neutron fission of 10,000 atoms of U^{235} were computed in terms of the experimentally determined values of half lives and fission yields. The decay curve of the fission-product aggregate and the relative contributions of individual nuclides and of elements at various times to the total activity were calculated from the basic $A_x(t)$ data. The decay curves of Way and Wigner (Phys. Rev. 73, 1318(1948)) are also shown for comparison. Approximate expressions for the gross activities in disintegrations per minute per 10^4 fissions were derived from the computed curve.

7319
INTERNAL PAIR CONVERSION IN Mg^{24} NUCLEI. Marshall R. Cleland, Jonathan Townsend, and A. L. Hughes. Phys. Rev. 84, 298-304(1951) Oct. 15.

A $\gamma-\gamma$ coincidence counting method is used to detect pair emission from an excited state of Mg^{24}. The positrons are stopped in absorbing material surrounding the source and detected by their annihilation radiation. The coincidence rate due to annihilation radiation is distinguished from the rate due to cascaded nuclear γ rays by the sharp 180-degree angular correlation of the annihilation radiation. Pair emission from Mg^{24} is distinguished from γ-ray pair production in the material surrounding the source by using materials of different atomic number Z. The efficiency of the apparatus for detecting positrons is determined by observing the coincidence rate from a Na^{22} source of known disintegration rate. This efficiency, combined with the fraction of the observed coincidence rate that is due to pair emission from Mg^{24} and with the known disintegration rate of the parent Na^{24} source yields a value of $(6.7 \pm 1.0) \times 10^{-4}$ for the internal pair-conversion coefficient of the 2.76-Mev transition in Mg^{24}. This value agrees with that calculated by Rose (Phys. Rev. 76, 678(1949)) for electric quadrupole transitions of this energy. (auth)

7320
EXPERIMENTAL EVIDENCE FOR ORBITAL ELECTRON EMISSION ACCOMPANYING BETA-DECAY. Joseph A. Bruner. Phys. Rev. 84, 282-8(1951) Oct. 15.

Experiments are described which indicate the existence of a mode of β distintegration in which the energy emitted is shared by three particles: β particle, neutrino, and ejected orbital electron. The energy spectrum of the orbital electrons ("IB electrons") from Sc^{44} has been measured over the range 30 to 150 kev. The "IB internal conversion coefficient" —that is, the ratio of the measured number of IB electrons to the number of internal bremsstrahlung (IB) predicted by the theory of Knipp and Uhlenbeck (Physica 3, 425(1936)) and Bloch (Phys. Rev. 50, 472(1936)) is found to be essentially constant over the measured energy range, and equal to 4.3. The frequency with which the three-particle disintegration takes place is about 0.04 times that of ordinary decay into a β particle and a neutrino. The measurements have an estimated accuracy of +3%, −20%. (auth)

7321

RADIATIONS FROM Ge^{69}. Charles M. Huddleston and Alan B. Smith. Phys. Rev. 84, 289-91(1951) Oct. 15.

The radiations from Ge^{69} (39.6 hr) have been studied with the help of a magnetic lens spectrograph. Gamma-rays of energies 0.090, 0.388, 0.576, 0.870, 1.12, 1.340, and 1.610 Mev have been found. The positron spectrum is complex and can be analyzed into three groups of end-point energies 1.215 Mev (88%), 0.610 Mev (10%), and 0.220 Mev (2%). Coincidence studies have also been made. A tentative energy level scheme is presented. (auth)

7322

DISINTEGRATION OF Ta^{180}. H. N. Brown, W. L. Bendel, F. J. Shore, and R. A. Becker. Phys. Rev. 84, 292-5(1951) Oct. 15.

The modes of decay of 8-hr Ta^{180} have been studied by means of a magnetic spectrometer and coincidence-absorption techniques. It is found that approximately 21% of the decays involve either of two negative β particles in transitions to states of W^{180}. The remainder of the decays proceed by means of K-capture to at least two different states of Hf^{180}. No positrons are observed. Very prominent conversion lines attributed to a 93-kev γ transition in Hf^{180} are observed, in addition to a weaker line considered to be associated with a 102-kev γ ray in W^{180}. Auger electrons are also present. The multipolarity of the 93-kev γ ray is thought to be electric quadrupole. (auth)

7323

THE DECAY OF Sr^{87m}, Y^{87m}, AND Y^{87}. Lloyd G. Mann and Peter Axel. Phys. Rev. 84, 221-30(1951) Oct. 15.

The 2.8-hr Sr^{87m}, 80-hr Y^{87}, and 14-hr Y^{87m} activities were studied by means of a thin-lens beta-ray spectrometer, Geiger counters in coincidence, and scintillation crystals. The following results were obtained: (a) Sr^{87m}: $t_{1/2} = 2.80 \pm 0.05$ hr, γ-energy = 390 ± 2 kev, K conversion coefficient = 0.24 ± 0.05, ratio of K to (L + M) conversion = 6.9 ± 0.4; (b) Y^{87}: $t_{1/2} = 80.0 \pm 1$ hr, decays to Sr^{87m}, more than 99% K-capture, 0.7-Mev positrons, gamma-ray follows K-capture with energy = 485 ± 3 kev and K conversion coefficient = $3.2 \pm 0.7 \times 10^{-3}$; (c) Y^{87m}: $t_{1/2} = 14 \pm 1$ hr, γ-energy = 384 ± 3 kev (definitely different from Sr^{87m} γ-ray), K conversion coefficient = 0.24 ± 0.07. These data are compared with the predictions of the theories of internal conversion, nuclear isomeric transitions, shell structure, and beta-decay. The results are incorporated in a decay scheme and probable spin and parity assignments are given. Conventional beta-decay theory and the spin orbit coupling shell model give incompatible assignments to the energy levels in Y^{87}. (auth)

7324

CHARACTERISTICS OF SOME RADIONUCLIDES OF TUNGSTEN, RHENIUM, AND OSMIUM FORMED BY SECOND-ORDER THERMAL NEUTRON CAPTURE. Manfred Lindner. Phys. Rev. 84, 240-4(1951) Oct. 15.

The identification and characteristics of several beta-emitting nuclides are reported. The half life of W^{188} is 65 days, Os^{194} about 700 days, while Re^{189} might be either of two isotopes having half lives of about 150 days or of at least 5 yr. The mass assignment of W^{181} has been confirmed in view of its presence in thermal-neutron irradiated tungsten. Re^{188} was found to have a half life of 16.9 hr. No gamma-radiation could be found by absorption measurements to be associated with the 18-hr Ir^{194} daughter of Os^{194}. Thermal-neutron activation cross sections are reported for most of these nuclides. (auth)

7325

THE α-γ ANGULAR CORRELATION IN THE DECAY OF RADIOTHORIUM. J. K. Beling, B. T. Feld, and I. Halpern. Phys. Rev. 84, 155-6(1951) Oct. 1. (Letter to the editor)

An energy-level diagram is presented for the levels in RdTh(Th^{228}) and ThX(Ra^{224}) which are displayed in the α decay of RdTh. It is based on measurements by other workers and includes two α particles of energy 5.33 and 5.42 Mev from the ground state of RdTh to an excited level and to the ground state of ThX, respectively, and two γ rays in ThX of energy 83 and 87 kev, not in cascade. The α-γ correlation was measured with scintillation counters to check the assumptions. The observed correlation was very pronounced. Most of the features of the decay scheme were confirmed, but no convincing fit was found between the observed correlation and those computed from several assumed angular momenta.

7326

THE K-CAPTURE/POSITRON BRANCHING RATIO IN Cu^{64}. E. Plassmann and F. R. Scott. Phys. Rev. 84, 156-7(1951) Oct. 1. (Letter to the editor)

The K-capture/positron branching ratio in Cu^{64} has been measured in a 180° magnetic spectrometer by comparing the relative intensities of the K Auger electrons and the positrons. The K Auger-electron distribution is shown. The complete momentum distribution of the positrons was obtained from a Fermi plot. A ratio of 1.18 ± 0.10 was found for the intensity of the K Auger electrons to the intensity of the positrons. The K-capture/positron ratio to the ground state of Ni is then 2.07 ± 0.20.

7327

THEORY OF INTERNAL CONVERSION. H. R. Coish. Phys. Rev. 84, 164-5(1951) Oct. 1. (Letter to the editor)

Tralli and Goertzel (Phys. Rev. 83, 399(1951)) have set up the completely quantum-mechanical internal-conversion problem and have solved it by successive approximations. They verify the first-order correction to N_q, the rate of radiation of photons, which Taylor and Mott (Proc. Roy. Soc. (London) 142A, 215(1933)) obtained by semiclassical correspondence-principle methods. Attention is now called to further corrections, of the same order in e^2, to the internal conversion coefficient N_e/N_q. These are obtained when the approximation for N_e is extended to the same relative order in e^2 as N_q.

7328

MIXED INVARIANTS IN BETA-DECAY AND SYMMETRIES IMPOSED ON THE INTERACTION HAMILTONIAN. H. A. Tolhoek and S. R. de Groot. Phys. Rev. 84, 150-1(1951) Oct. 1. (Letter to the editor)

Two types of symmetries that can be imposed on the interaction hamiltonian which is used in the theory of β radioactivity are given, and their consequences are stated. The first condition is that the interaction energy must be invariant if all four particles are transformed to the antiparticles. Two alternative formulations of the second condition of symmetry are given. One of them follows: the processes of negatron and positron emission must be symmetrical in such a way that if coulomb interaction is neglected, the expressions for the interaction energy H_{β^-} and H_{β^+} are equal if the following conditions are satisfied: the wave functions of the emitted (positive and negative) electrons and neutrinos must be physically equivalent, and $\psi_f(p)$ and $\psi_i(n)$ for negatron emission must be, respectively, the same as $\psi_f(n)$ and $\psi_i(p)$ for positron emission (i initial; f final; n neutron; p proton).

7329

THE NATURAL RADIOACTIVITY OF RUBIDIUM. S. C. Curran, D. Dixon, and H. W. Wilson. Phys. Rev. 84, 151-2 (1951) Oct. 1. (Letter to the editor)

The radiation from Rb^{87} has been investigated with a large proportional tube spectrometer. Two thicknesses of RbCl were used as source, 1.5 mg/cm² above 40 kev and 0.128 mg/cm² for lower energies. The β spectrum observed and a Kurie plot of the data are shown. The limiting energy E_0 was found to be 275 kev. No maximum is observed on the

curve, and the intensity increases rapidly with decreasing energy down to at least 10 kev. The average energy is only 44 kev. The transition is third forbidden with log ft = 17.6. It is concluded that the process $Rb^{87} \rightarrow Sr^{87} + \beta^-$ is a simple ground-to-ground-state transition. The half life is $6.15 \pm 0.3 \times 10^{10}$ yr.

SHIELDING

7330

BARYTES AGGREGATES MAKE HEAVY CONCRETE FOR SHIELDING. Edward G. Tirpak. Civil Eng. 21, 453-6(1951) Aug. (See also NSA 5-3563)

Tests made at Oak Ridge National Laboratory are described which showed that barytes can be used to produce a heavy concrete (220 lb/cu ft^3) suitable for cell construction and for shielding purposes. The difference in cost between this and standard concrete was the difference in cost of the aggregates. Extra care in tying and bracing forms was found to be advisable. Recommended specifications for heavy concrete are included.

SPECTROSCOPY

7331

Brookhaven National Lab.

COMPARISON OF ABSORPTION SPECTRUM OF URANIUM TETRACHLORIDE WITH THAT OF PRASEODYMIUM TRICHLORIDE AND OF URANIUM TRICHLORIDE WITH THAT OF NEODYMIUM TRICHLORIDE; by Kenneth M. Sancier and Simon Freed. [nd] 17p. (BNL-1008)

The absorption spectra of the following substances were taken at 77°K: crystals of anhydrous UCl_4, $PrCl_3$, UCl_3, $NdCl_3$, UF_4, and a solution of UCl_4 in a solvent consisting of propyl alcohol, propene, and propane. The spectra of the "isoelectronic" ions U^{+4} and Pr^{+3} exhibited a match in wave number of the centers of gravity of the separate absorption groups. These correspondences between U^{+4} and Pr^{+3} lead to term assignments for the basic and activated electronic states of U^{+4} since those of Pr^{+3} are known. Thus the two least stable electrons of U^{+4} in the basic state, and to a good approximation in the excited states, lie within the 5f shell. The interaction of the fields of the environment of the ions in the case of U^{+4} is greater than in the case of Pr^{+3}. The correlation of the spectra of U^{+3} and Nd^{+3} is less distinct even though the same approach may well be valid in view of their similar color. The areas of absorption are not as distinctly separate and may even overlap.

7332

Brookhaven National Lab.

THE MICROWAVE SPECTRUM OF FURAN; by M. H. Sirvetz. Oct. 5, 1951. 7p. (BNL-1009)

The heterocyclic 5-membered ring compound furan was found to give rise to more than 50 strong absorptions in the microwave k-band. Of these, 26 have been assigned to specific rotational transitions. Observed and computed frequencies are tabulated. The derived rotational constants correspond to a planar molecule of near oblate symmetry, with electric dipole moment oriented along the principal axis of least moment of inertia. It is estimated that frequencies determined are accurate to better than 0.1 Mc.

7333

ISOTOPE SHIFT IN THE Ce II SPECTRUM AND THE MAGIC NUMBER 82. Kiyoshi Murakawa and John S. Ross. Phys. Rev. 83, 1272-3(1951) Sept. 15. (Letter to the editor)

The isotope shift in the spectrum of Ce II was studied, using an enriched sample of cerium (Ce^{138} 4.4%, Ce^{140} 92.0%, Ce^{142} 3.5%), a hollow-cathode discharge tube, and a Fabry-Perot etalon. In λ 4628 the Ce^{142} was well resolved, the spacing 140 to 142 being 0.055/cm. The Ce^{138} component was not resolved, and the upper limit of the spacing 138 to 140 was found to be ~0.029/cm. The isotope shift per one 6s electron in the neutral atom per addition of two neutrons was calculated from experimental data for Ba, Ce, Sm, Eu, Gd, Yb, W, Os, Ir, Pt, Hg, Tl, and Pb. This isotope shift is plotted as a function of neutron number. There is a distinct rise in the diagram in passing from N = 80 to N = 82, and a large anomaly in the isotope shift for N = 88 to 90 can be seen.

THEORETICAL PHYSICS

7334

ON THE PROBLEM OF MAGNETIC MOMENTS OF NUCLEONS. I. G. Heber. Ann. Physik (6) 9, No. 2-4, 151-68(1951). (In German)

For the purpose of calculating the magnetic moments of nucleons, the equations of nucleon fields with scalar coupling to real scalar meson fields with field quantization in the Heisenberg representation have been integrated according to Kallen's method to the second order of the coupling constant. The vacuum expectation value of the electric current density operator has been calculated to the second order for the one-nucleon, no-meson state, and from this has been taken the magnitude of the magnetic moment of the nucleon arising from its meson coupling. The calculation is Lorentz invariant, charge symmetric, and invariant under the Pauli-Villars proposed "formal regularization." The results are in complete agreement with those of Case (Phys. Rev. 76, 1(1949)).

7335

ON THE PROBLEM OF MAGNETIC MOMENTS OF NUCLEONS. II. G. Heber. Ann. Physik (6) 9, No. 2-4, 169-80(1951). (In German)

The method described in I (see preceding abstract) is extended to consideration of scalar or pseudoscalar coupling with a complex scalar or real complex pseudoscalar meson field. As before, the results agree with those of Case.

7336

ON THE LIGHT FROM SYNCHROTRON BEAMS. Haakon Olsen and Harald Wergeland. Kgl. Norske Videnskab. Selskabs Forh. 23, 91-5(1950).

Radiations from electrons moving in circular orbits, which gained new interest in connection with high-energy particle accelerators, have been the object of a theoretical study by Schwinger (Phys. Rev. 70, 798(1946)). Some supplementary features of the calculation of the special distribution function are examined here.

7337

THE MECHANISM OF nD CAPTURE. Norman Austern. Phys. Rev. 83, 672(1951) Aug. 1. (Letter to the editor)

The usual calculations of thermal neutron-deuteron capture cross section postulate an antisymmetric ^2S term in the ground state as an explanation of the capture process. It is now shown that this interpretation of the capture process is not a unique one. Two additional methods are discussed. Magnetic dipole capture via the interaction moment does not obey the selection rules which limited the possible transitions via the spin moments; electric quadrupole capture can occur from the continuum ^4S state to ground state ^4D terms.

7338

j-j COUPLING SHELL MODEL AND BETA-DECAY. H. Horie and M. Umezawa. Phys. Rev. 83, 1253-4(1951) Sept. 15. (Letter to the editor)

The nuclear matrix elements $\int 1$ and $\int \sigma$ for allowed β transitions are evaluated in the $TJT_\zeta M_J$ scheme, where T is the charge multiplicity, J the total angular momentum, T_ζ is the third component of T (i.e., half of neutron excess), and M_J is the z component of J. The β decay of mirror and of even-mass nuclei is considered, and it is concluded that

the Fermi-type interaction is the main part of the allowed β transitions and that the Gamow-Teller one is subsidiary. In order to explain the shape of β-ray spectra and the ft values, the following types of matrix elements are necessary: 1 (mirror nuclei), $\int \sigma$ (even mass nuclei) B_{ij} (a-shape spectra of Y^{90}, Sr^{90}, etc.), S_{ijk} (c-type spectrum of B^{10}), S_{ijkl} (K^{40}), and probably A_{ij}, T_{ij} (Cl^{36}, RaE^{210}, Tc^{99}). In order to include all these matrix elements, more than two interactions are necessary; that is, (I) T and one of S or V interactions, or (II) V and AV interactions are necessary.

7339
THEORY OF DIBARIC PARTICLES. Jane S. Pease. Phys. Rev. 84, 167(1951) Oct. 1. (Letter to the editor)

The possible physical significance of a system of spin 1 whose properties are intermediate between those of the vector meson and those of the electron has been investigated. The system was introduced as a mathematical artifice by J. Schwinger. Such a system may be interpreted physically as a pair of strongly coupled spin-½ particles of different mass, and after investigating its properties the author concludes that the theory is meaningful only in the nonrelativistic limit. The system is dibaric in that it can exist in either of two mass states.

7340
BOUND STATES IN QUANTUM FIELD THEORY. Murray Gell-Mann and Francis Low. Phys. Rev. 84, 350-4(1951) Oct. 15.

The relativistic two-body equation of Bethe and Salpeter (Phys. Rev. 82, 309(1951)) is derived from field theory. It is shown that the Feynman two-body kernel may be written as a sum of wave functions over the states of the system. These wave functions depend exponentially on the energies of the states to which they correspond and therefore provide a means of calculating energy levels of bound states. (auth)

7341
APPLICABILITY OF THE RENORMALIZATION THEORY AND THE STRUCTURE OF ELEMENTARY PARTICLES. Shoichi Sakata, Hiroomi Umezawa, and Susumu Kamefuchi. Phys. Rev. 84, 154-5(1951) Oct. 1. (Letter to the editor)

One of the most striking defects of the renormalization theory is found in the problem of the anomalous magnetic moment of the nucleon. However, it is possible to add a magnetic moment of Pauli type having finite or infinite value in accordance with the idea of renormalization. The condition for the renormalization theory as applied to the most general type of interaction to form a closed system in the frame of the present quantum field theory is given, and this condition is used to classify the various types of interaction.

7342
RADIATIVE CORRECTIONS TO THE INTENSITIES FOR HYDROGENLIKE ATOMS. T. Tati. Phys. Rev. 84, 150 (1951) Oct. 1. (Letter to the editor)

The radiative corrections to the transition probabilities for the transitions of excited hydrogenlike atoms with single-photon emission are calculated in nonrelativistic approximation. A value of 2×10^8/sec is calculated for the probability of the $2s_{½} - 2p_{½}$ transition caused by the radiative reaction.

TRITIUM AND TRITIUM COMPOUNDS

7343
ESTIMATION OF TRITIUM AND SOME PRELIMINARY EXPERIMENTS ON ITS USE AS A LABEL FOR WATER. R. F. Glascock. Nucleonics 9, No. 5, 28-34(1951) Nov.

A method is described for determining the tritium in radioactive water by allowing the water to react with an excess of dry butyl magnesium bromide and counting the resultant tritiobutane in the Geiger region of a gas counter. Butane was found not to be a self-quenching gas. A preliminary experiment on the in vivo uptake of tritium and deuterium from doubly labeled body water into fat of the mammary gland and liver of the rat has indicated that the incorporation of tritium is relatively less than that of deuterium. In another experiment it was demonstrated that insulin added in vitro stimulates the incorporation of C^{14}-labeled acetate plus radioactive water into fat by rat mammary-gland slices.

PATENTS

PHYSICS

7344
DETECTION OF SCATTERED NEUTRONS. Kenneth C. Crumrine (to The Texas Co., New York, N.Y.) U. S. Patent 2,549,176, Apr. 17, 1951.

Back-scattered slow neutrons from a sample in a neutron flux produce fission in an appropriate isotope; the fission products then cause fluorescence of a further material, and the resulting photons are converted to an electric current. The current, when amplified gives a measure of the neutrons.

7345
INTEGRATING COUNTER CIRCUIT. Eugene R. Shenk and Arthur E. Canfora (to R.C.A., Delaware) U. S. Patent 2,549, 022, April 17, 1951.

An integrating impulse-counting circuit is described which minimizes the effects of spurious pulses of shorter duration than the pulses to be counted by introducing a delay in the building up of a charge on a capacitor.

7346
AMPLIFYING AND PULSE SELECTING CIRCUIT FOR RADIATION DETECTORS. Kenneth C. Crumrine. (to The Texas Co., New York, N. Y.) U. S. Patent 2,557,636, June 19, 1951.

An amplifying and selecting circuit for use with a radiation detector is described. The detector delivers variable size pulses to the first channel of the amplifier which amplifies and delivers all pulses to an electron discharge tube which selects and delivers only the larger positive pulses to the second channel of the amplifier. The second amplifying channel receives both the larger positive pulses and negative pulses from a point in the circuit before the selecting tube and from these positive and negative pulses forms an integrated combined unidirectional voltage which is a function of the number and amplitude of the pulses. The unidirectional voltage is then impressed upon the grid of the selector tube to control and stabilize the action thereof.